DISTRIBUTION, SEASONAL ABUNDANCE, AND FEEDING DEPENDENCIES OF JUVENILE SALMON AND NON-SALMONID FISHES IN THE YUKON RIVER DELTA

by

Douglas J. Martin,
Domoni R. Glass, and Clifford J. Whitmus
Envirosphere Company
10900 N.E. Eighth Street
Bellevue, Washington 98004

Charles A. Simenstad,
Douglas A. Milward, and Eric C. Volk
Fisheries Research Institute
University of Washington
Seattle, Washington 98195

Marty L. Stevenson,
Pepsi Nunes, and Mark Savoie
Kinnetic Laboratories, Inc.
3050 Paul Sweet Road
Santa Cruz, California 95061

Richard A. Grotefendt
13504 - 432nd Avenue S.E.
North Bend, Washington 98045

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1.0 INTRODUCTION

In autumn 1984 Envirosphere Company was awarded a contract to conduct a one-year investigation of the distribution, seasonal abundance, and feeding dependencies of juvenile salmon and non-salmonid fishes in the Yukon River Delta. Initial field investigation began with a small synoptic survey which was conducted during December 1984. A larger open-water survey was conducted during June through September 1985. This report contains the results of both surveys and includes an assessment of the potential vulnerability of fish and delta habitats to oil and gas development.

The events which led up to this study initially began on March 15, 1983 when the U.S. Department of the Interior accepted 59 bids for oil and gas exploration in Norton Sound (Sale No. 57). This lease sale area is located on the outer continental shelf just north of the Yukon River Delta. Since this region supports a large subsistence and commercial fishery, baseline studies were needed to assess the potential impacts of oil and gas development. In response to this need for scientific information, the Outer Continental Shelf Environmental Assessment Program (OCSEAP), the National Oceanic and Atmospheric Administration (NOAA) contracted with LGL Ecological Research Associates, Inc. to conduct a literature review which resulted in an Ecological Characterization of the Yukon River Delta (Truett et al . 1985). This characterization identified the estuarine environment (including the nearshore delta platform and the delta distributaries influenced by marine water) as most vulnerable to adverse effects of oil in the delta. However, site specific information concerning physical processes, fish distribution, and habitat utilization in the Yukon River Delta was very limited. This information would be necessary to assess potential environmental impacts and to enable management decisions necessary to protect fishery resources. Consequently, OCSEAP initiated a field investigation of the physical processes and fishery resources of the Yukon River Delta during 1984.

1.1 OBJECTIVES

The objectives of this study as specified by NOAA/OCSEAP are to:

1) Describe the population levels, residence times, and feeding dependencies of juvenile salmon in the Yukon Delta estuarine region.

2) Determine the population levels, seasonal distributions, and feeding dependencies of non-salmonid fishes in the delta channels, delta front, and delta platform.

3) Determine the vulnerabilities of these fish populations to the potential effects of proposed OCS oil and gas activities.

1.2 STATUS OF CURRENT KNOWLEDGE

The abundance and seasonal distribution of fishes on the Yukon Delta is largely unknown, except for adult salmon. Two to five million adult salmon annually migrate through the delta environment to spawning areas upriver (Starr et al. 1981). All five species of Pacific salmon are found in the Yukon River with chum salmon being the most abundant (1,900,000-5,300,000), followed by chinook (500,000), pink (less than 300,000), coho (less than 100,000) and sockeye (Geiger et al. 1983, Starr et al. 1981). Studies on adult salmon in the Yukon River system have defined age, sex, size composition, run timing, and spawning areas for chum and chinook (Bucklis 1981, 1982; U.S. Fish and Wildlife Service 1957).

Information on juvenile salmon use of the Yukon Delta is limited to one study conducted by Barton (1983). Barton sampled the lower Yukon River in the vicinity of Flat Island and Kwikluak Pass during 1976 and the main river channel near the mouth of Anuk River in 1977. Catches of juvenile chum and chinook salmon near Anuk occurred immediately after sampling began on June 7. Catches of juvenile chum peaked on June 13, and declined to low levels by June 24. Chinook salmon were caught throughout the study period (June 7 through July 7); however, their numbers were too small (less than 3 per day) to identify a peak. Samples collected near Flat Island indicate juvenile salmon were present in the estuary until mid July. Water temperature in the river during the peak of the chum salmon smelt outmigration ranged between 9-11°C and was 16°C at the end of the outmigration period. Based on these data, the duration of habitat utilization in the immediate nearshore areas of the delta is relatively short (i.e., June 1 through mid July). However, Barton (1983) did not sample intertidal mudflat areas or the shallow waters of the delta platform.

Information on the food habits of juvenile salmon for the Yukon Delta is essentially non-existent. Barton (1983) examined a few salmon (3 chum, 3 chinook) caught near the Anuk River and found freshwater prey items (i.e., aquatic insects and small fish) in the stomachs.

Very little information exists concerning the distribution, abundance, and food habits of non-salmon fishes in the Yukon Delta. Whitefish, sheefish, and blackfish are harvested on a commercial basis and also contribute to an important subsistence fishery throughout the Yukon drainage (Geiger et al. 1983). Barton (1983) caught starry flounder in the South Mouth channel near Flat Island, suggesting that this species is present on the delta platform. Starry flounder probably utilize the delta platform as a nursery ground based on the tendency for juveniles of this species to migrate into brackish, warmer waters. Length-frequency distributions presented by Wolotira et al. (1977b) indicate that fish collected in Norton Sound near the delta platform are smaller. This region could be a major source of larger individuals found in the more northerly regions studied by Wolotira et al. (1977a).

Arctic flounder probably utilize the delta platform, like the starry flounder, since this species is often found well into brackish water. In Wolotira's survey, arctic flounder were found in abundance only off the Yukon Delta. Saffron cod, which was the dominant marine species in Wolotira's survey (both biomass and abundance), would also be expected to be abundant on the delta platform.

Information on the food habits of non-salmon fishes on the Yukon Delta is limited to the unpublished studies of tundra lakes conducted by Rae Baxter (personal communication). A summary of his work indicates, in general, that broad and humpback whitefish are bottom feeders in the tundra lakes and insect larvae and mollusks are their most important prey items. Adult sheefish, pike, and blackfish are all picivorous, and the Bering cisco, least cisco, and ninespine sticklebacks are plankton feeders.

In summary, the distribution, abundance, and food dependencies of juvenile salmon and non-salmon fishes on the Yukon Delta are largely unknown. Based on the review of relevant literature, it is apparent that significant populations of economically important fish utilize specific habitats on the delta. However, the timing and duration of habitat utilization and food habits of these species need to be defined. This study provides a significant advance in the understanding of the Yukon Delta and its use by fish.

2.0 DESCRIPTION OF STUDY AREA

The Yukon River Delta is located along the southwestern coast of Norton Sound, Alaska, which is located in the northeastern corner of the Bering Sea (Figure 2-l). The study area includes all waters within and adjacent to the fan-shaped delta extending northward from the mouth of the Black River on the southwest coast. The emergent portion of the delta is characterized as a gentle sloping plain (slope of 1:5,000) with active and inactive distributary channels, channel bars, natural levees, interdistributary marshes, and lakes (Dupre 1980). The land is generally flat and contains low willow, alder, cottonwood, sedge, and native grasses as the dominant vegetation types (U.S. Fish and Wildlife Service 1957). Seaward of the emergent edge of the delta, the prograding delta platform extends as far as 30 km offshore with typically shallow water (up to3 m) and a gentle sloping bottom (1:1000 or less). Adjacent to the delta platform is the steeper delta front with water depth ranging 3 to 14 m (Dupre 1980).

The Yukon River is subdivided into three major distributaries (Kwikluak or South Mouth, Kawanak or Middle Mouth, and Apoon or North Mouth) which are further subdivided into smaller distributaries as it approaches the coast. The larger distributary channels continue as offshore subsea extensions that are typically .5 to 1 km wide, 5-15 m deep, and extend up to20 km beyond the shoreline (Dupre 1980).

2.1 DYNAMIC PROCESSES

Discharge of the Yukon River has a dynamic seasonal pattern. During the winter,discharge follows a slow declining pattern from 92,000 - 168,000 cfs in November to 38,000 - 50,000cfs in April (based on USGS water discharge records for Pilot Station, years 1976 - 1983). In spring, runoff causes a rapid increase in discharge to a peak of 750,000 cfs during June. During the summer and autumn, discharge steadily declines again to November levels (based on USGS water discharge records for Pilot Station, years 1976 - 1983). The Yukon River transports a large suspended sediment load which causes water

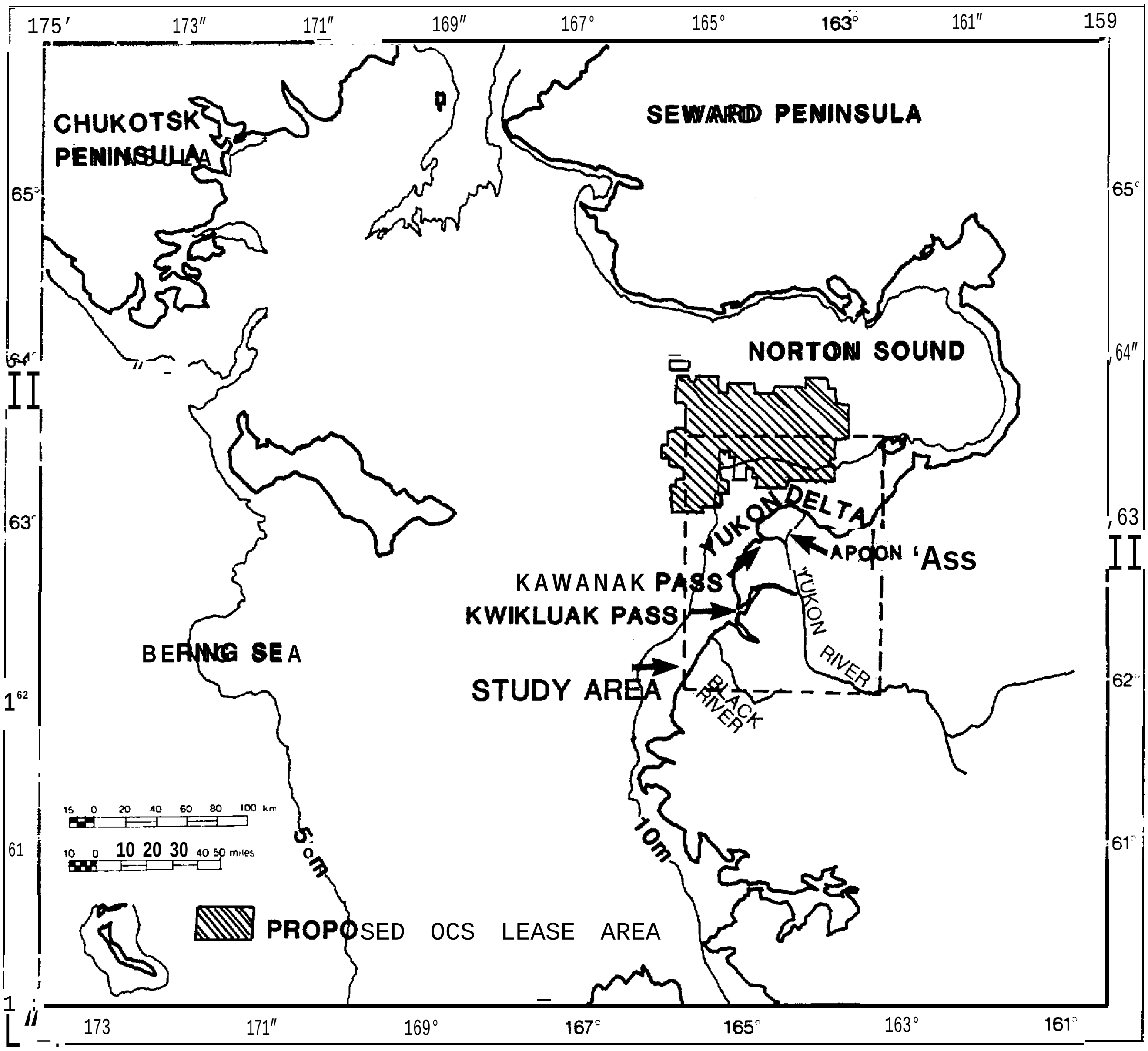

Figure 2-1. Vicinity map of Norton Sound showing the location of the Yukon River Delta study area.

to be opaque in active distributaries and coastal areas as far offshore as the delta front.

The tidal cycle in the Yukon Delta is a mixture of diurnal and semi-diurnal tides depending on location and the time of year (NOAA/NOS 1984). The diurnal tidal range at the face of the delta is about 1-2 m. Water levels are also affected by storm surges which can occur at any time but are more frequent during autumn. Storm surge frequencies of 3.3 m every 100 years, 2.4 mevery 10 years, and 0.4 - 1.2 mevery year are given by Wise et al. (1981).

The winter ice period begins with ice formulation in October and ends with ice breakup in May. Bottom-fast ice develops to approximately the 1 m isobath and shorefast ice extends to a distance of 15 to 60 km offshore. Spring breakup is initiated by the large increase in river discharge which causes floating ice to lift, both in the river and along the coast. During this period the increased discharge and ice jams cause extensive flooding and river bank erosion. Southerly winds which predominate at this time push warmer water into the region and promote ice melting. Floating and shorefast ice are usually gone by June (Dupre 1980).

3.0 METHODS AND MATERIALS

3.1 STUDY DESIGN

This survey was designed to investigate the seasonal distribution, abundance, and feeding dependencies of juvenile salmon and non-salmon fishes that utilize the Yukon River Delta. Since fisheries information was limited, field surveys were conducted during both winter and summer. The greatest effort, however, was expended during the open water period when juvenile salmon are most abundant and potential vulnerability to oil-related impacts are greatest.

The study region (Figure 2-1) covers a large geographic area and includes a diversity of aquatic habitat types. Therefore, in order to determine habitat utilization patterns, the study region was stratified into eight major habitat types, some of which were partitioned into sub-types to aid in description of sample sites (Table 3-l). Habitats were characterized by differences in morphology, elevation and location. One or more sites representative of each habitat type were sampled during synoptic surveys of the region in order to identify the spatial distribution of fishes.

Greater emphasis was placed on active distributary and coastal habitats (i.e. tidal slough and mudflat) as these areas were more likely to be utilized by juvenile salmon. Also, during the summer survey, a number of sites were sampled repeatedly in order to identify temporal variations in abundance and the duration of habitat utilization. The duration of residence for juvenile chum salmon was further defined through an examination of otolith microstructure.

Vulnerability of these fish populations to the potential effects of oil and gas development was based on species occurrence, relative abundance, and duration of residence within each habitat.

TABLE 3-1

DEFINITION OF AQUATIC HABITAT TYPES INVESTIGATED IN THE YUKON RIVER DELTA

Habitat Major Type Sub-Type	Code	Definition
Delta Front	1	A zone that is approximately 5 kmwide and located at the outer margin of the delta platform with water depths ranging from 3 to 14 m.
Delta Platform		The shallow water zone that extends from the outer edge of the coastal mudflats to the delta front. This zone may extend 20-30 km seaward from the coast and may be only 3 m deep.
Mid Delta Platform	2	Portion of delta platform where sub-sea channels pass through the delta platform. Channels range from 0.5 to 1.0 km wide with water depths ranging to 30 m.
Inner Delta Platform	3	Refers to a portion of the delta platform located within 4-8 km of the coast.
Mudflat	4	The narrow intertidal zone extending from the emergent coastal edge to as far as 1 to 1.5 km offshore. Water depth ranges to 1.0 m at high tide.

TABLE 3-1 (Continued)

DEFINITION OF AQUATIC HABITAT TYPES INVESTIGATED IN THE YUKON RIVER DELTA

Habitat Major Type Sub-Type	Code	Definition
Tidal Slough	5	Small dendritic waterways that extend into and drain marsh areas along the coast. The width and length of these channels vary with tidal level and they may become dry at low tide. The outer edge and banks of these channels contain dense marsh grass which becomes flooded during high tide.
Active Distributary		
Major	6	Large river channels ranging from 0.5 to 3 km wide that flow year round.
Minor	7	Smaller river channels (< 0.5 kmwide) that flow most of the year.
Inactive Distributary		
Major	11	Large dead-end drainage channel (0.5 to 3 km wide) that connects to an active distributary.
Minor	8	Smaller dead-end drainage channel (< 0.5 km wide) .

TABLE 3-1 (Continued)

DEFINITION OF AQUATIC HABITAT TYPES INVESTIGATED IN THE YUKON RIVER DELTA

Habitat Major Type Sub-Type	Code	Definition
Lakes		
Lake Outlet	10	Small channel connecting a lake with an active distributary or slough.
Connected Lake	9	Lentic environment surrounded by the delta marsh that is connected to an active distributary or slough by an outlet channel.
Landlocked Lake	13	Lentic environment surrounded by the delta marsh with no outlet channel.
Inter-Island Channels	12	Small active channels that separate islands and bars along the delta coast line.

Feeding dependencies of juvenile salmon and other important fishes were determined by examination of stomach contents from selected subsamples obtained during the summer survey. The dependence of fish on foods produced in delta habitats was also incorporated into the vulnerability analysis.

3.1.1 Winter Survey

The winter survey of the Yukon River Delta was conducted from December 3rd through December 13th, 1984. Fish were collected during a synoptic survey of active and inactive distributary habitats, most of which were located along the coastline (Figure 3-l). Water quality data were collected in conjunction with the fish sampling program. A list of the geographic coordinates and a description of each sample site is shown in Table 3-2.

An attempt was made to supplement data developed from the sampling program with catch data derived from an inventory of local fishermen. However, after several days of travel to villages on the delta (i.e., Emmonak, Alakanuk and Sheldon's Point) little information concerning catch (i.e., species and location) was obtained from the local people. The 'inventory crew found that it was difficult to locate and talk to people having direct knowledge of fishing conditions.

3.1.2 Summer Survey

The summer survey extended from June 14th through September 18th, 1985. Field crews were on site by June 3rd, but sampling did not begin until June 14th due to the late breakup of ice in the lower delta. The sample program involved several synoptic (i.e., geographically extensive) surveys of the delta region and repeated sampling at several selected study sites. Samples were collected from 54 sites that were representative of the 13 habitat types identified in Table 3-1 (Figure 3-2). Most of the sample sites, however, were representative

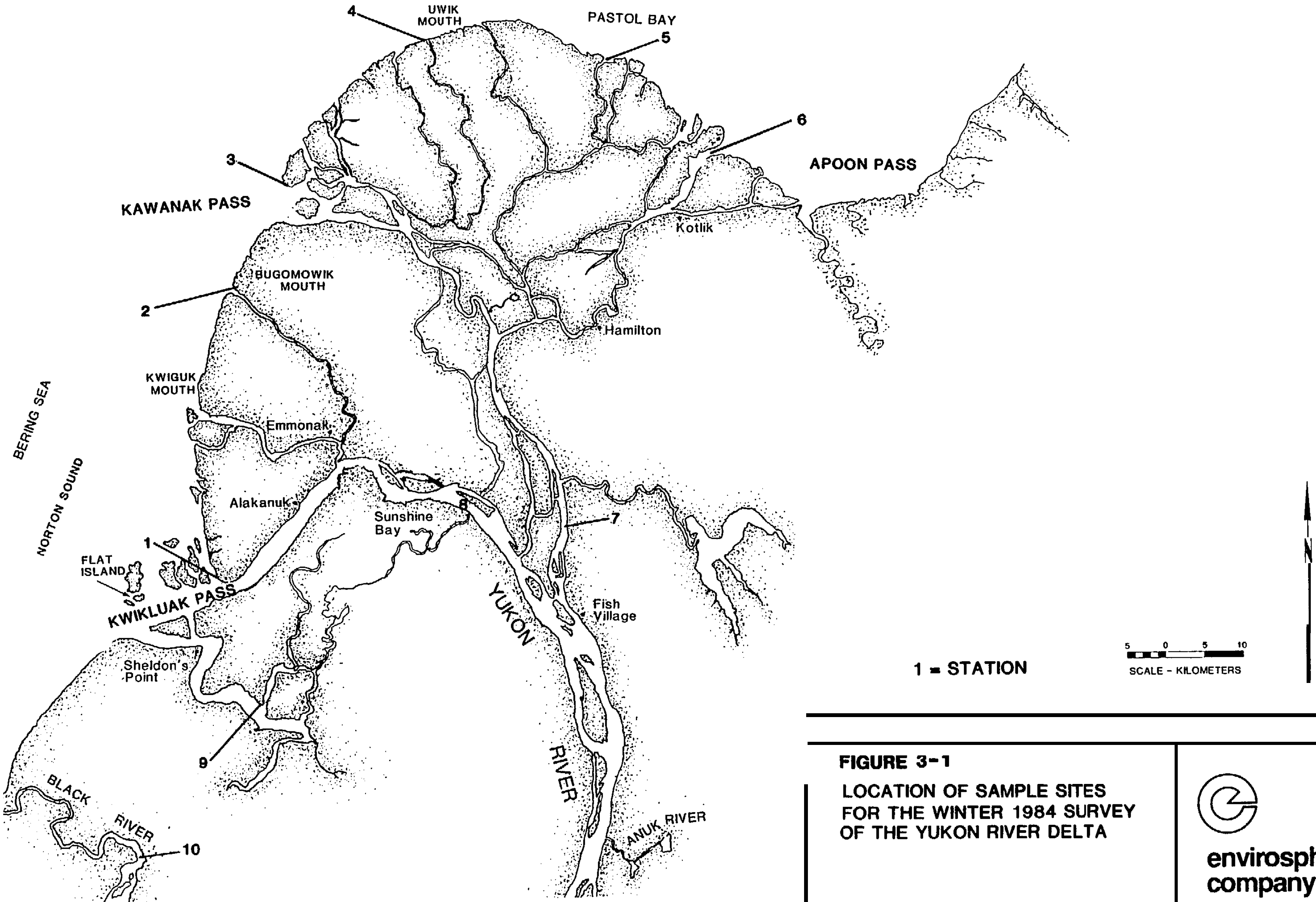

FIGURE 3-1

LOCATION OF SAMPLE SITES
FOR THE WINTER 1984 SURVEY
OF THE YUKON RIVER DELTA

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TABLE 3-2

LOCATION, DESCRIPTION, AND SAMPLE DATES FOR THE WINTER 1984 SURVEY OF THE YUKON RIVER DELTA

Station Number	Description	Latitude	Longitude	Date Sampled
1	Minor Act. Dist. - Eastside of Casey's Channel	62"36.8	164047.8	Dec. 9-10
2	Minor Act. Dist. - Bugomowik Slough Mouth	62'57.3	164"46.3	Dec. 8-9
3	Major Act. Dist. - Nunaktuk Island	63004.3	164"38.2	Dec. 7-8
4	Minor Act. Dist. - Elongozhik Slough Mouth	63*14. 1	164"16.6	Dec. 9-10
5	Minor Act. Dist. - Okshokwewhik Pass Mouth	63"12.7	163049.5	Dec. 10-11
6	Major Act. Dist. - Okwega Pass Mouth	63 "06.4	163032.6	Dec. 11-12
7	Major Act. Dist. - Kwikpuk,Kwikpak Pass	62040.3	163055.7	Dec. 12-13
8	Major Act. Dist. - Near Akularak Pass	62"41.8	164"11.1	Dec. 11-12
9	Major Inactive Dist. - Kwemeluk - Kanelik Jet.	62-27.9	164040.9	Dec. 12-13
10	Minor Act. Dist. - Black River	62015.9	164"59.0	Dec. 12-13

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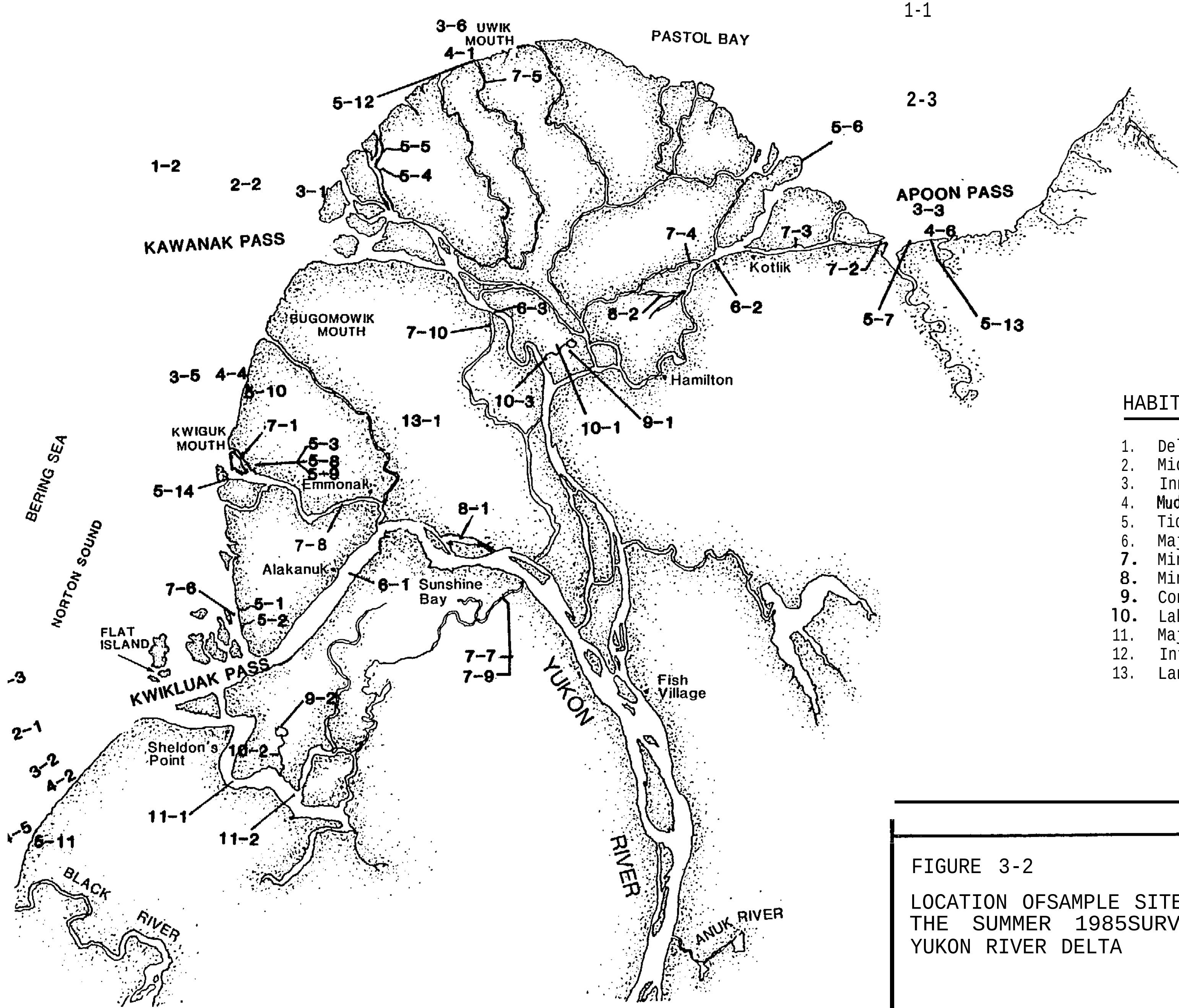

STATION CODE

1-1

HABITAT LOCATION

HABITAT DESCRIPTION

1. Delta Front
2. Mid-Delta Platform
3. Inner-Delta Platform
4. Mudflat
5. Tidal Slough
6. Major Active Distributary
7. Minor Active Distributary
8. Minor Inactive Distributary
9. Connected Lake
10. Lake Outlet Channel
11. Major Inactive Distributary
12. Inter-Island Channels
13. Land locked Lake

FIGURE 3-2

LOCATION OF SAMPLE SITES FOR THE SUMMER 1985 SURVEY OF THE YUKON RIVER DELTA

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of active distributary and coastal habitats. A description of each sample site,including the geographic coordinates,is listed in Table 3-3.

3.2 SAMPLING TECHNIQUES

3.2.1 Water Quality Measurements

During the winter, water temperature, dissolved oxygen, conductivity, salinity, and water clarity were measured at each fish sampling station. All parameters except water clarity were measured at 1.0 m depth increments. Teinperature, conductivity, and salinity were measured with a Beckman R5-3 conductivity/temperature instrument and dissolved oxygen was measured with a YSI model 51B dissolved oxygen meter. Water clarity at the surface was visually categorized as clear, slightly turbid (tea color), or turbid (no viability below surface).

During the summer water quality measurements were made using two basic approaches. The first approach involved the installation of continuously recording physical/water quality instrumentation at selected locations within the Delta. The second method involved taking discrete measurements by field crews in conjunction with fish sampling and other project operations.

Instrumentation was installed at five locations in the study area (Figure 3-3, Table 3-4) in order to provide continuous measurements of water level, temperature, and conductivity. Salinity was then calculated during data processing from conductivity, temperature and depth. SeaData TDR-2A tide gauges equipped with temperature and conductivity sensors were placed near the mouths of the southern most distributary and the northern most distributary. Aanderaa RCM-4 meters fitted with pressure, temperature and conductivity sensors were installed near the entrance to the Middle Mouth, approximately 25 km upriver in Kwikluak Pass near its junction with Kwiguk Pass (Big Eddy), and 50 km upriver in Kwikluak Pass near its junction with Naringolapak S1 OU gh .

TABLE 3-3

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude (N)	Longitude (W)
1-1	Delta front - North Mouth	63 19.74	163 08.21
1-2	Delta front - Middle Mouth	63 08.49	16505.82
1-3	Delta front - South Mouth	62 26.16	165 37.32
2-1	Mid delta platform - South Mouth	6230.06	165 15.84
2-2	Mid delta platform - Middle Mouth	63 08.17	16448.48
2-3	Mid delta platform - North Mouth	63 11.47	163 11.94
3-1	Inner delta platform - Middle Mouth	63 06.07	16441.24
3-2	Inner delta platform - south of South Mouth	62 31.18	165 11.60
3-3	Inner delta platform - east of Pastolik River	63 04.73	163 15.28
3-5	Inner delta platform - south of Bugomowik	62 54.20	16448.10
3-6	Inner delta platform - west of Elongozhik	63 18.50	164 17.00
4-1	Mudflat - west of Elongozhik	63 18.50	164 17.00
4-2	Mudflat - south of South Mouth	62 31.18	165 10.00
4-4	Mudflat - south of Bugomowik	62 54.20	16448.10
4-5	Mudflat - Black River	62 26.50	165 16.90
4-6	Mudflat - east of Pastolik River	63 01.70	163 15.80
5-1	Tidal slough - off Casey’s Channel	62 39.19	164 51.13
5-2	Tidal slough - off Casey’s Channel	62 38.37	16451.13
5-3	Tidal slough - north of Kwikuk Mouth	62 50.50	16449.00
5-4	Tidal slough - trib. to Kochluk Pass, Mid	63 05.80	16429.00
5-5	Tidal slough - trib. to Kochluk Pass, Mid	63 05.80	164 29.00
5-6	Tidal slough - in outer island at Okwega Pass	63 07.00	16432.00

TABLE 3-3 (Continued)

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude (N)	Longitude (w)
5-7	Tidal slough - 1st channel east of Apoon Mouth	63 02.00	163 22.00
5-8	Tidal slough - northwest of Kwiguk Pass	6248.00	16447.00
5-9	Tidal slough - same as 5-8	62 48.00	16447.00
5-1o	Tidal slough - south of Bugomowik	62 54.20	16448.10
5-11	Tidal slough - Black River	62 26.50	165 16.90
5-12	Tidal slough - west of Elongozhik	63 18.30	164 17.00
5-13	Tidal slough - east of Pastolik River	63 01.70	163 15.80
5-14	Tidal slough - Island in Kwiguk Mouth	62 49.00	164 50.00
6-1	Major active dist - near Alakanuk	62 40.82	164 36.62
6-2	Major active dist - south of Kotlik	62 59.70	16348.96
6-3	Major active - several miles upriver of Sea Gull Point	62 58.75	164 16.61
7-1	Minor active - north of Kwiguk Mouth	62 50.50	16449.00
7-2	Minor active - atApoon Mouth	6302.68	16324.68
7-3	Minor active - Tatlinguk Pass, NE of Kotlik	63 02.69	163 31.80
7-4	Minor active - Apakshaw jet., east of Kotlik	63 01.28	163 50.86
7-5	Minor active - near Elongozhik Mouth	63 13.80	164 17.29
7-6	Minor active - in Casey's Channel	62 39.29	164 51.18
7-7	Minor active - east of Sunshine Bay	62 40.84	164 17.02
7-8	Minor active - Kwiguk, west of Emmonak	62 45.66	16438.75
7-9	Minor active - SE of Sunshine Bay	62 40.00	164 17.00
7-1o	Minor active - Kwikpakak Slough	6300.81	16423.63
8-1	Minor inactive - Utakaht Slough	62 43.80	164 19.50
8-2	Minor inactive - Chapeluk Slough, Apoon	62 59.30	163 52.20

TABLE 3-3 (Continued)

LOCATION AND DESCRIPTION OF STATIONS SAMPLED

DURING THE 1985 FIELD SEASON OF THE YUKON DELTA FISHERIES STUDY

Station Number	Description	Latitude (N)	Longitude (W)
9-1	Lake - 2.5 km east of Choolunawick	62 56.50	164 04.40
9-2	Lake - north of Kwemeluk Pass, west of Kanelik Pass	62 30.40	16444.20
10-1	Lake outlet - 2.0 km east of Choolunawick	62 57.10	16405.90
10-2	Lake outlet - north of Kwemeluk Pass, west of Kanelik Pass	62 30.20	16443.90
10-3	Lake outlet - 0.6 km downstream of Station 10-1	62 57.10	164 07.00
11-1	Major inactive channel - SE of Sheldon's Point	62 28.00	164 50.00
11-2	Major inactive channel - Kwemeluk/Kanelik Jet.	62 27.00	164 41.00
12-1	Inter-island channel - north of South Mouth, east of Flat Island	62 36.80	164 51.80
13-1	Landlocked lake - NE of Emmonak, west of Kravaksarak	62 51.80	164 23.30

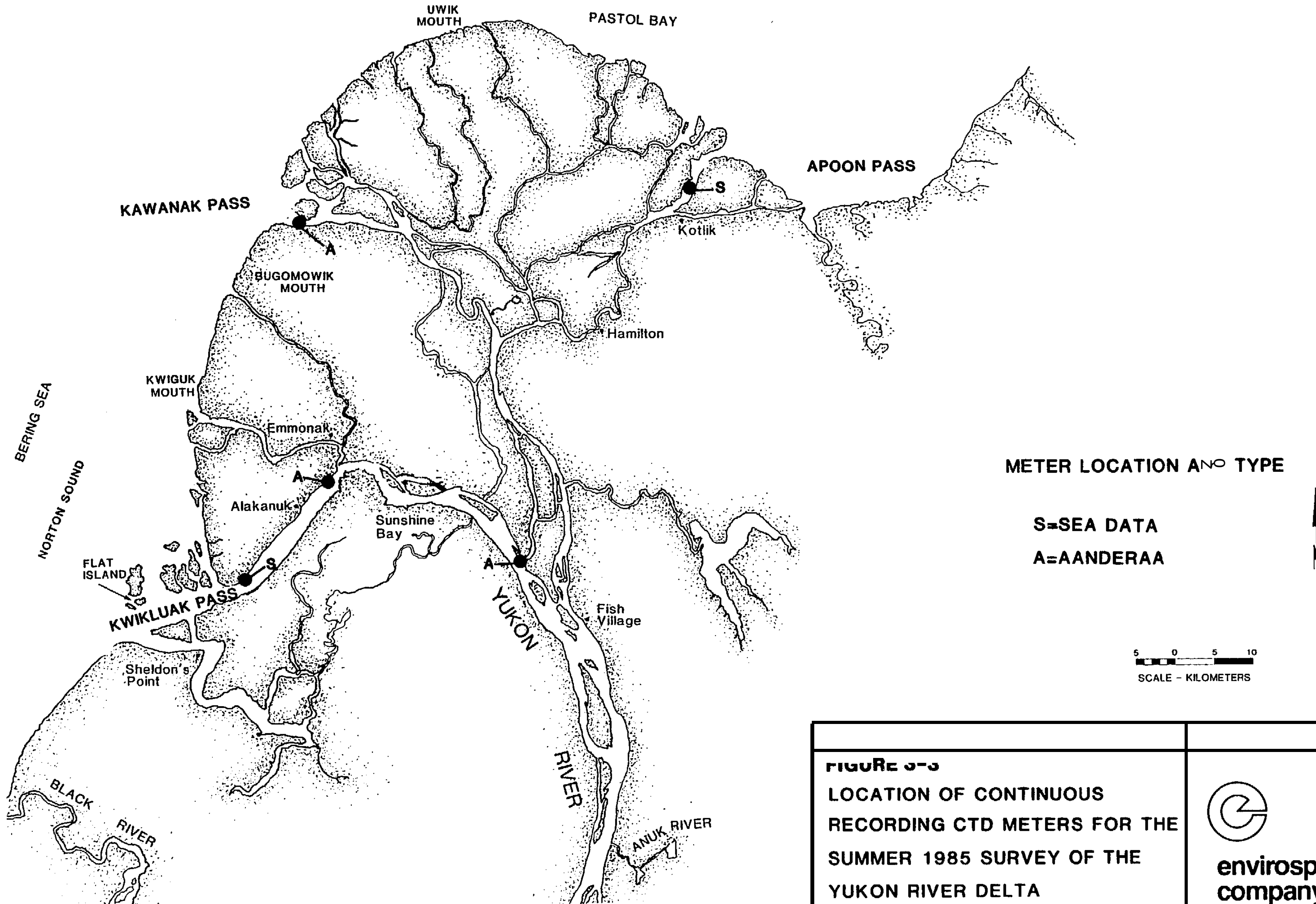

FIGURE 3-3
LOCATION OF CONTINUOUS RECORDING CTD METERS FOR THE SUMMER 1985 SURVEY OF THE YUKON RIVER DELTA

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TABLE 3-4

WATER QUALITY EQUIPMENT DEPLOYMENT AND RECOVERY LOG

FOR THE SUMMER 1985 SURVEY OF THE YUKON RIVER DELTA

Station	Instrument	Oate		Location		Meter Depth (m)	Water Depth (m)	Comments
		deployment	Recovery	Latitude (North)	Longitude (West)			
South Mouth (Kwikluak Pass)	SeaData TDR-2A	11 June 1985	15 Sep 1985	62° 36.88’	164° 46,17’	7	7.5	>715 feet of bank collapsed removing shore anchor -- groundline found afloat
Big Eddy	Aanderaa RCM-4	11 Jun 1985	-----	62° 43.99′	164° 32.33′	9	9.5	Missing groundline -- meter not recovered after two days effort
Naringolapak S1 ough	Aanderaa RCM-4	12 Jun 1985	30 Sep 1985	62″ 37.60′	164° 02.24′	10	10.5	Meter partially buried due to collapse of bank -- recovered by divers
North Mouth	SeaOata TDR-2A	19 Jun 1985	12 Sep 1985	63° 04.28′	163° 37.21′	7	7.5	Okay
Middle Mouth	Aanderaa RCM-4	22June 1985	9Sep 1985	63″ 02.16′	164° 35.69′	4.5	5	Mooring possibly dragged during September storm surge

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All instruments were bottom mounted in order to provide the highest probability of detecting potential salinity intrusions. Each 'instrument was vertically mounted on a metal-framed quadrapod such that the sensors were located approximately half a meter from the bottom. Attached to the frame's lifting bridle was a 200-foot, 3/8-inch nylon groundline which was anchored onshore.

All equipment placed in the field was tested by standard set-up and checkout procedures at the base camp prior to deployment. After initial checkout procedures, sampling intervals were programmed into each meter. Each meter was then monitored to assure proper operation.

Sampling intervals for all instruments were set to half hour intervals but the method of data recording differed between the two types of instruments used in this study. The Aanderaas were capable of recording only a single reading of each sensor at each sampling interval. The SeaData meters, however, are capable of sampling each sensor repetitively (bursting) and recording a single averaged value for each sensor. These meters were set to read 128 records at one second intervals during each burst in order to eliminate high frequency noise from the data.

Discrete surface and bottom measurements were taken by field crews throughout the duration of the study. These measurements were taken at the same time that experimental fishing efforts were undertaken, and at the same stations. Discrete measurements were taken at these stations for water depth, conductivity, temperature, and turbid"ity.

A Beckman RS-5 conductivity/temperature instrument was used for part of these discrete measurements, with handheld thermometers and a YSI Model 31 conductivity meter used for the rest of the measurements. Water depths were measured with a Echotec fathometer. A standard Secchi disc (200 mm diameter) was used to measure water transparency.

3.2.2 Fish Sampling

In order to sample the diversity of habitats encountered in the Yukon River Delta a variety of sampling gears was deployed. The specifications for each fishing gear are listed in Table 3-5 and a description of how each gear was deployed is shown in Figure 3-4. During the winter all habitats were sampled with a 16 m long variable mesh gill net. Nets were positioned in a horizontal configuration just beneath the ice and were fished for a period of 20-26 hours. In addition, gee-type minnow traps baited with salmon eggs were deployed at all but three sample sites. However, no fish were caught at these sites.

During the summer a 136.8 m purse seine was used to sample the delta front, mid-delta and major active distributary habitats where the water was greater than 7 m deep. The purse seine was set in a "C" shaped configuration by two boats and towed with the open end of the "C" directed into the current for a period of ten minutes (Figure 3-4e). Two seine hauls were usually collected at each sample site,

The inner delta platform was sampled with a double-bodied fyke net which consists of two single-body fyke nets attached at the opposite ends of a center lead (Figure 3-4a). Fyke nets were set 5-9 km offshore in water 1-2 m deep and were fished for a period of 4-30 hours. Nets were positioned with the center lead parallel to the direction of the current, Attempts to position the center lead perpendicular to the current direction were unsuccessful because fine organic debris clogged the nets causing it to rip or break loose from the anchor. These nets were deployed from a rubber raft (Zodiac) because water depth over the inner delta platform was too shallow for operation of a larger craft. Consequently, the number of net sets was often limited by poor weather which inhibited operations of the raft.

The mudflats, inactive distributaries, and lake habitats were sampled by a single-body fyke net with either a 60.8 m (used in mudflats) or a 30.4 m (used in other habitats) center lead. The nets were positioned

TABLE 3-5

SPECIFICATIONS FOR FISH SAMPLING GEAR USED FOR THE WINTER 1984 AND SUMMER 1985 SURVEYS OF THE YUKON RIVER DELTA

Gear		Specification
Purse Seine	Overall size:	136.8m long x 7.3 m deep
	Outer lead:	45,6 m long x 7.3 m deep, 31.75 mm (stretch) knotless mesh
	Body :	76 m long x 7.3 m deep, 19.05 mm (stretch) knotless mesh
	Bunt:	15,2 m long x 7.3 m deep, 6.35 mm (stretch) knotless mesh
Beach Seine	Overall size:	22.8 m long x 2.4 m deep at center and tapered to 1.8 m deep at end of wings.
	Bag:	7.7 m long x 2.4 m deep, 6.35 mm (stretch) knotless mesh
	Wings:	2 each, 7.7 m long x 2.4 m deep near center and tapered to 1.8 m deep atend, 12.7 mm (stretch) knotless mesh.
Hook Seine	Overall size:	45.6 m long x 3.0 m deep at center and tapered to 2.4 m deep at end of wings
	Bag:	15.5 m long x 3.0 m deep, 6.35 mm (stretch) knotless mesh
	Wings:	2each; 15.5 m long x 3.0 m deep near center and tapered to 2.4 m deep atend, 12.7 mm (stretch) knotless mesh.
Double-Body Fyke Net	Each Body:	4.3 m long with 7 square frames, 2-mouth frames 0.9 m x 0.9 m 5 body frames 0.6 m x 0.6 mwith 6.35 mm (stretch) knotless mesh, and 2-throats with a 15.2 cm x 25.4 cm opening
	Wings:	Two 4.6 m long x 2.1 m deep with 25.4 mm (stretch) knotless mesh
	Lead:	30,4 m long x 2.1 m deep with 25.4 mm (stretch) knotless mesh

TABLE 3-5 (Continued)

SPECIFICATIONS FOR FISH SAMPLING GEAR USED FOR THE WINTER 1984 AND SUMMER 1985 SURVEYS OF THE YUKON RIVER DELTA

Gear		Specification
Single-body fyke net	Body:	4.3 m long with 7 frames, 2-mouth frame 0.9 x 0.9 m, 5 body frames 0.6 m x 0.6 m with 6.35 mm (stretch) knotless mesh, and 2-throats with a 15.2 cm x25.4 cm opening
	Wings:	Two 4.6 m long x 1.2 m deep with 25.4 mm stretch mesh
	Lead:	60.8 m long x 1.2 m deep for mudflats, 30.4 m long x 1.2 m deep for lakes, 25.4 mm stretch mesh
Gill net, Summer	Size:	45.6 m long x 1.8 m deep monofilament
	Panels:	5 each, 9.1 m long x 1.8m deep with variable mesh 25, 50, 75, 100, and 150 mm stretch
Gill net, Winter	Size:	16.0 m long x 2.5 m deep multifilament
	Panels:	4each, 4mwidex 2.5 m deep with variable mesh 25, 75, 100, and 150 mm stretch
Gee Minnow Trap, Winter	Size:	44.4 cm long x 22.9 cm diameter with 6.35 mm square wire mesh

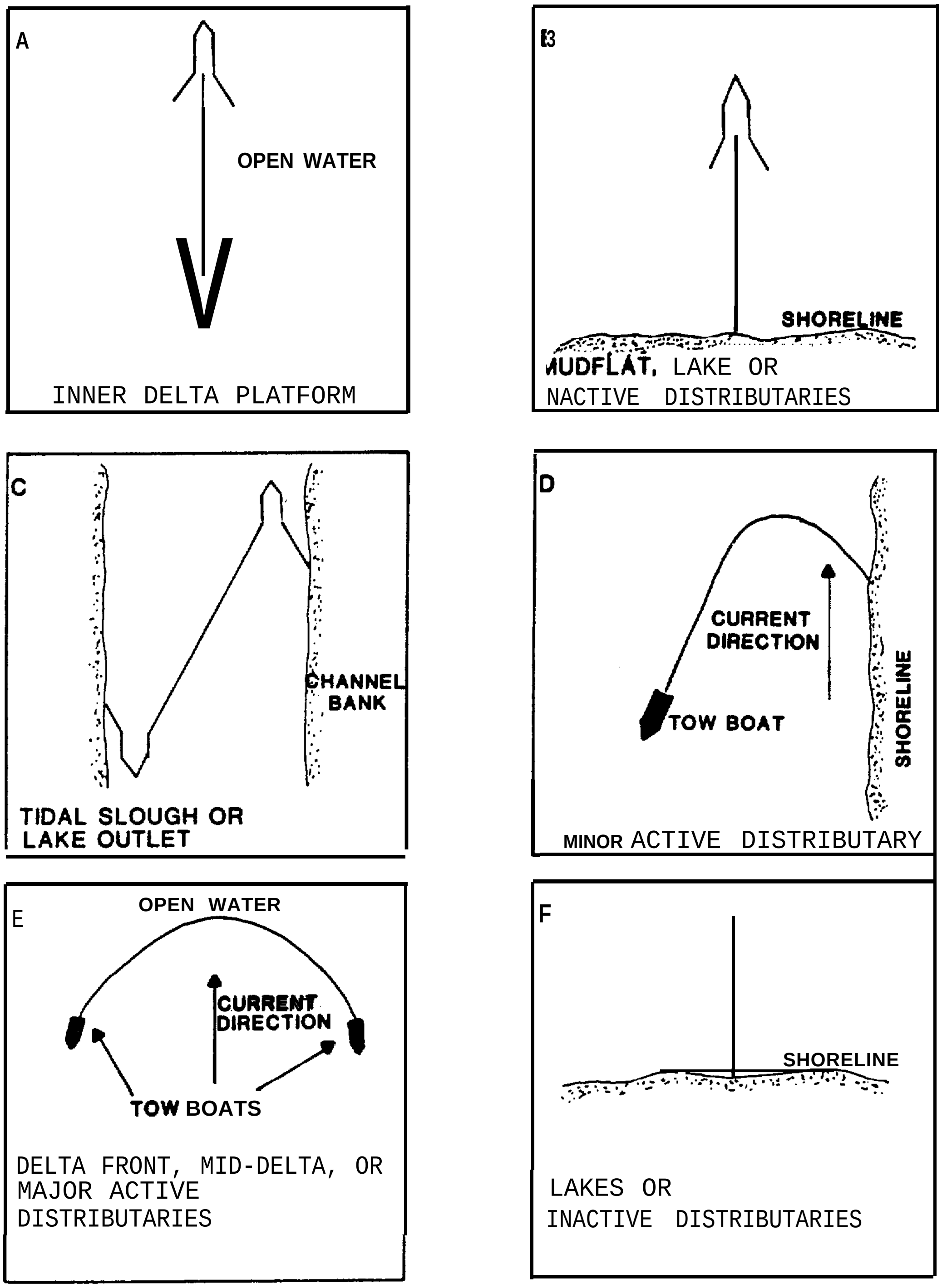

Figure 3-4. Net configurations used to sample the various aquatic habitats in the Yukon River Delta: A) double-body fyke net; B) single-body fyke net; C) tidal net or lake outlet trap; D) hook seine; E) purse seine; and F) gill net.

perpendicular to the shoreline with the center lead attached to shore (Figure 3-4b) . Nets were set for periods ranging 17-34 hours and nets located in the mudflats became dewatered for an unknown period during the low tide. Predation was not considered to be a significant problem during the low tide period because of the small mesh size. However, in one case, a gull was found trapped in the net.

Tidal sloughs and lake outlet channels were sampled with two single-body fyke nets that were zipped together in a "Z" shaped configuration (Figure 3-4c). The net extended across the entire channel width, thus enabling the direction of fish movement to be determined from the catch. Nets were fished for periods ranging 18-36 hours in all cases except for one site located in a lake outlet channel. In the latter case, a net was set at station 10-1 (Figure 3-2) and fished continuously from June 30th through August 9th. This net was checked at intervals of 1-4 days depending on the size of the catch.

Tidal sloughs were initially sampled (i.e. prior to July 9th) with a 22.8 m long beach seine (Table 3-5). The seine was pulled for distances ranging 50-100 m and sampled the entire width of the slough. This procedure was replaced, however by the "Z" configuration fyke net because catch data obtained by the latter method were more comparable with catch data from fyke nets which were used for sampling other habitats,

Minor active distributaries were too narrow or too shallow to be sampled with the purse seine. Therefore, these habitats were sampled with a 45.6 m long beach seine that was anchored to the shore and held open against the current in a hook shaped configuration (Figure 3-4d). After a 10 minute set, the net was retrieved on shore with a procedure similar to a beach seine haul.

Inactive distributaries, lakes, lake outlet channels and some tidal sloughs were sampled with a 45.6 m long variable mesh gill net (Table 3-5) . Nets were positioned perpendicular to the shoreline (Figure 3-4f) with the smallest mesh panel located near shore. Nets were set for periods ranging 15-33 hours.

3.2.3 Catch Processing, Data Recording and Archival

Fish were processed in one of two ways depending on the number of individuals in the catch. When catches were small (less than 1000) each individual was identified to species and counted. When catches were large (greater than 1000) a random subsample was collected to determine the relative proportion of each species in the catch. The total number of fish in the catch was estimated from measurements of the volume of the total catch and from the volume and number of fish in a subsample. All fish except rare marine species, juvenile whitefish, and juvenile cisco less than 100 mm were identified to species. Rare specimens were classified to family or genera, and juvenile coregonids were listed as unidentified whitefish or unidentified cisco.

Fish lengths were measured from a random subsample (minimum of 40 individuals unless fewer than 40 fish were present in the catch) of each species from each sampling effort.

Samples of at least five specimens of each target fish species were collected from selected sites for stomach and/or otolith analysis. Chum salmon juveniles were preserved in 70 percent ethyl alcohol in order to maintain the integrity of the otoliths. All other fish were preserved in 10 percent buffered formalin. The stomachs of larger specimens (eg. sheefish) were removed from the body cavity and preserved separately while smaller fish were preserved whole.

All field data were recorded on a polycorder. The polycorder is a portable computer with its own operating system and programming language designed specifically for data logging in the field. An electronic data sheet, formatted specifically for this project, was programed into the polycorder. The data from the polycorder were downloaded daily onto floppy disks. Minor editing (e.g. editing station number, date, time, etc.) was performed on the raw data file immediately after downloading and a backup copy of the edited data file was made and archived. Also, a hard copy of the edited data files was made daily and stored separately from the rest of the data.

3.3 LABORATORY PROCEDURE

3.3.1 Stomach Analysis

Fish stomach contents analyses were performed using a systematic procedure (Terry 1977). This procedure identifies the occurrence, numerical, and gravimetric composition of prey organisms in the stomach contents, the stage of contents' digestion, and the degree of stomach fullness.

For individual stomach specimens, prey items were sorted to the lowest phylogenetic and life history stage possible under an illuminated dissecting microscope. These taxa/life history categories were enumerated and weighed. Stomach fullness was evaluated and coded from 1 (empty) to 7 (distended) and digestion of stomach contents coded similarly from 1 (all unidentifiable) to 6 (no digestion evident). Data were recorded directly onto modified NODC format 100, record type 6 computer forms using the NODC taxonomic and other codes. In the final reporting to NOAA, these data will be reformatted to NODC format 123, in accordance with the other project data.

3.3.2 Otolith Analysis

Five juvenile chum salmon from each of six collection sites were measured for fork length and dissected to remove their otoliths (sagittae). Otoliths were cleaned with 95 percent ethanol. One otolith from each fish was prepared for analysis by grinding both sides on 600 grit sandpaper, then polishing with one micron diamond paste. After preparation, otoliths were cleaned ultrasonically in 95 percent ethanol and placed on a microscope slide in immersion oil.

Sagittae were first examined at 100x to determine the possible presence of distinguishable microstructure patterns which may correspond to the migration of these fish from a riverine to an estuarine environment (Volk et al. ins., Neilson et al. 1984). Once the hypothesized transition zone was identified, its size was measured with an ocular micrometer along the same standard radius as that used by Volk et al. (1984). The number of otolith increments was also counted in this zone at a magnification of 500x.

3.4 ANALYTIC PROCEDURES

3.4.1 Water Quality

Pressure measured by each CTD meter is the total hydrostatic pressure of the water column which fluctuates with the tide, storm surge, and river level, plus the atmospheric pressure. Atmospheric pressure obtained from National Weather Service six-hour weather maps was subtracted from the gauge pressure before converting to water elevations. A linear interpolation was used between each six-hour reading.

Using a first order low pass recursive filter with a cut-off frequency of 0.5 cycles/hour, the water level data was processed, decimating the data to hourly intervals. A Doodson filter, a low pass filter designed to pass only tidal frequencies,was then passed over the decimated time series and finally the mean was removed. The resulting time series then contained variations in water level due only to tidal components. These methods were applied only to data from meters set at the mouths of the distributaries since tidal influence, although evident, was minimal in the inner delta.

Seven tidal constituents (01, Kl, N2, M2, S2, M4, M6) were fitted to the tidal height time series using a least squares harmonic analysis program developed by NOS/NOAA with further developments added by U.S.G.S., Menlo Park, California.

The surge time series was obtained by taking the water level time series (data after initial decimation of the time series) and subtracting the tidal height time series. The surge is then the change in water level due to storm surge and river flow relative to the pressure transducer for that time series. Time series plots of temperature, water level, tide elevation and storm surge are presented for each meter (except for the meter deployed at the Naringolapak station near the Head of the Passes where only temperature and water level were plotted).

Discrete measurements were corrected by appropriate sensor calibration factors and then tabulated by station.

3.4.2 Species Characterization

Anadromous, marine, and freshwater fish species important to the commercial and subsistence fisheries were characterized in terms of their size composition, relative abundance, run timing, and spatial distributions, Size composition was determined from length frequency analysis. Fish were sorted by 10mm size groups and length frequency distributions were computed for each habitat and for each semi-monthly time interval. Relative abundance was expressed as catch per unit effort (CPUE) for each sample gear. The unit of effort was variable and depended upon gear. Catch in all fyke net configurations and gill nets were standardized to a 24 hour period; catch in the purse seine and hook seine were standardized to a 10 minute haul; and, catch in the beach seine was standardized to a 50m haul. All replicate samples taken at a site on the same date were combined and expressed as one CPUE. Run timing was identified with histogram plots of CPUE versus time. Graphs for each species and station were compared in order to identify differences and similarities in the temporal utilization of habitat. Temporal and spatial distribution were determined from the histogram plots, and from tables of species occurrence by semi-monthly time interval and habitat category.

3.4.3 Chum Residence Time

Residence time for juvenile chum salmon was determined from an analysis of the number of daily growth increments occurring in the otolith edge zone. The otolith edge zone is defined as the outer zone of an otolith where increment width is markedly greater than the increment widths of the interior growth increments. The point of transition from narrow increment widths to wide increment widths was assumed to mark the point of transition from freshwater growth to estuarine growth. This assumption was based on a previous study that showed the growth of juvenile chinook salmon increased greatly upon entry into the estuary and this growth was reflected in greater otolith increment widths (Neilsen et al. 1984). The number of increments in the edge zone reflect the recent growth history and provide a measure of residence time in the delta estuarine environment. Residence time estimates for each habitat are based on the average number of growth increments in the edge zone. Residence time within the delta was also identified from an otolith increment frequency histogram.

3.4.4 Fish Stomach Contents Data

Tabulation and basic statistical description of the stomach analysis data were performed using an FRI computer program package, GUTBUGS/IRI (Swanson and Simenstad, 1984) developed specifically for the NODC-type stomach analysis data format. This program package tabulates the sources (identification numbers, sample numbers, location numbers), numbers of specimens from each sample, and the time of collection. All stomach samples are itemized according to life history stage. Empty stomachs are listed, the percentages of empty stomachs are calculated and the adjusted sample size (stomachs containing prey) determined. Only stomachs containing prey are utilized in the subsequent tabulation and statistical description. The mean, range, and standard deviation of the fullness and digestion indices, total contents weight, total contents abundance, fish length and weight, and percent ratio of contents weight to fish weight ("instantaneous ration") are tabulated. For each prey taxon and life history stage identified from the combined stomach sample, the following statistics are given: frequency of occurrence, mean, range, and standard deviation of the prey abundance and biomass, the mean and standard deviation of the average individual prey biomass, and the percentage composition by abundance (numerical composition), total biomass (gravimetric composition), and standardized biomass (biomass less the unidentified material). The total number of prey categories and common diversity indices (Shannon-heaver, Brillouin) were also computed to summarize the taxonomic, numerical, and gravimetric diversity of the stomach contents sample.

GUTBUGS/IRI is designed to be operated at any one of four common truncation levels (species, genus, family, class) of the NODC taxonomic code, facilitating comparisons between stomach contents samples with differing stages of contents digestion. The IRI version of GUTBUGS utilizes a modification of Pinkas et al. (1971) Index of Relative Importance (IRI) to rank the importance of prey taxa to a selected sample or group of samples of fish stomach contents data (Cailliet 1977). Utilizing the GUTBUGS data summary, the IRI values for prey taxa categories (which can be set at one of the three code truncation levels) are computed and displayed both graphically and in tabular form.

Comparisons of diet composition were based upon a standardized measure of prey taxa importance, percent SIRI, which is the percentage which a discrete prey taxa constitutes of the sum of all IRI values in the prey spectrum. The degree of overlap in fish diet composition was quantitatively evaluated using the PSI overlap index, which is calculated by summing the lowest percent SIRI of each taxa pair between two diet spectra (Cailliet and Barry 1979).

3.4.5 Relationships Between Catch and Physical Parameters

Relationships between fish catch and habitat were identified through an association of species occurrence at each station with the environmental characteristics observed at each station and habitat. Correlations are assumed from qualitative associations rather than from quantitative associations (e.g. regression) because standardization of fishing gear was not possible, resulting in non-comparable catches between gear types.

3.4.6 Potential Impacts of Oil and Gas Development

An assessment of the potential impact of oil pollution on fish and fish habitats of the Yukon River Delta was based on indices of habitat importance and sensitivity of fish to petroleum oil contamination. These indices were developed from the study results and from literature information concerning oil impacts. Consideration was given to the time spent in a habitat by a particular species, the relative abundance of that species, the contribution made to the local community by that species, and the relative sensitivity of a species to petroleum hydrocarbons or its weathered derivatives. A matrix of index values for each of these factors was developed and then combined to form an index of relative impact for each habitat. This index provides a relative measure of the magnitude of potential impact on the fish community if a specific habitat is contaminated by oil. This analysis is based on the assumption that all habitats in the Yukon Delta could decontaminated by oil and does not evaluate the likelihood that such an accident would occur. An assessment of the latter would require information on tidal dynamics, currents and storm surge which is not available at this time.

The magnitude of potential impacts to the fish community was expressed on a scale ranging from 0 to 10. A high value implies that a large number of important fish species would be vulnerable to oil pollution impacts if a spill occurred in a specific habitat during a specific time period. On the other hand, a low value indicates that either a small number of fish and/or fish species of little importance would be vulnerable to impact in a specific habitat during a specific time period. This impact index varies from that used by the Mineral Management Service (Truett and Craig 1985) in that it indicates the relative size and importance of the population that may be vulnerable to an impact rather than indicating the relative size of the population impacted if an oil spill occurs.

Species considered in index calculations included chinook, pink, and chum salmon, sheefish, whitefish, cisco, northern pike, burbot, saffron cod, herring, blackfish, smelt, and starry flounder. These species represented 91 percent of the total catch and all are species of importance to the commercial and subsistence fisheries. Other species occurred infrequently and were not considered to contribute significantly to habitat rankings.

3.4.6.1 Index of Duration of Occurrence and Abundance

Index values for duration of occurrence and abundance for each species and habitat combination were developed by month and for the whole sampling season using weekly and monthly catch per unit effort values. Index values were not determined for major and minor inactive distributaries, connected lakes, and inter-island channels because these habitats were not sampled on a frequent enough basis to determine seasonal trends in distribution and abundance.

The relative abundance of a species was assigned to three levels of abundance (1 to 3) which represent low, moderate, and high abundance. The assignment of relative abundance values was done on a gear by gear basis (Table 3-6). Abundance levels assigned to catch in the purse seine were partitioned into two groups because of differences in catch efficiency between habitats. There was an insufficient degree of overlap of gear types within each habitat to permit the standardization of units of effort. As a result, it was necessary to assume that the ranges of abundance levels assigned to each gear type represented similar concentrations of fish.

Levels of abundance for each species were assigned on a weekly basis for each habitat. In cases where no sample was taken in a particular habitat during a one week interval, relative abundance was estimated by

TABLE 3-6

RANGES OF MONTHLY CATCH PER UNIT EFFORT

ASSIGNED TO ABUNDANCE LEVELS BY GEAR TYPE

Gear Type	Abundance Level 1 (Low)	2 (Moderate)	3 (High)
Purse Seine			
Delta Platform	< 25	25-49	≥ 50
Major Active Distributary	< 10	10-24	≥ 25
Double Fyke	< 25	25-49	≥ 50
Single Fyke	< 50	50-99	≥ 100
Beach Seine	< 25	25-49	≥ 50
Gill Net	< 10	10-24	≥ 25
Lake Outlet Trap	< 10	10-19	≥ 20
Tidal Net	< 50	50-99	≥ 100
Hook Net	< 25	25-49	≥ 50

iteration between two dates when samples were taken assuming any change in population level was constant between samples. Duration of occurrence was calculated as the proportion of a monthly time period during which a species occurred in a given habitat.

When samples were not taken in a habitat during a one week interval, duration of occurrence was estimated by observing the existence or absence of a species in the catch. If a species occurred or was missing in the periods before and after a period in question, the species was considered to occur or to be missing continuously. Where presence of a species changed between periods, the period at which the species first or last occurred in a habitat was determined to be the midpoint between sampled periods.

Cisco and whitefish were assumed to occur continuously in river channels. This assumption was based on knowledge of the distribution and life history of these species and was partially confirmed by the observed distribution of these species in both the summer and winter studies. In sampling periods where no catches of these species were observed in the river habitats, the abundance of these species was assumed to be low and was assigned the lowest value of relative abundance.

The landlocked lakes were only sampled in August. Blackfish were the only species found in these lakes; thus their existence and abundance were assumed to be constant within this habitat type given the impossibility of migration into or out of these lakes during the summer.

The inner delta platform was not sampled during July; therefore assumptions were made about species presence and abundance during this period. Species distribution on the inner delta platform generally was similar to that on the mid-delta platform. The same species which occurred on the mid-delta platform were assumed to occur on the inner delta platform. These included chinook salmon, chum salmon, pink salmon, sheefish, ciscoes, whitefish, and cod. Each of these species was found in low abundance on the mid-delta platform; therefore, low abundance was assumed to occur on the inner delta platform.

Additional assumptions concerning the distribution and abundance of fish were as follows. In the month of September, cod were observed in catches everywhere from the delta front to the mudflats and into tidal sloughs except along the mid-delta platform. This seemed improbable, and cod were therefore assumed to occur on the mid-delta platform in low abundances. Additionally, it was apparent that small numbers of chum were continuing to migrate down the river through the end of the sampling season. During the late periods of the season, no chum were observed on the delta platform. Earlier in the season, when chum abundances were considerably larger, chum were found on the delta platform and appeared to migrate through this habitat. It was assumed that the small numbers of chum migrating late in the season continue to use the platform as a migration route, and low abundance levels were assigned to those habitats despite the lack of chum in catches.

3.4.6.2 Index of Contribution to the Local Community

An index of importance of each species to the local community was developed using historical records of commercial and subsistence catch. To determine relative contribution of each species to the total fish harvest by the community, a ten year average catch (1974-1983) of saltwater and anadromous species and 5-year average catch (1979-1983) of freshwater species taken in the lower Yukon area, District 1, as reported by the Alaska Department of Fish and Game (ADF&G, 1983b) were used. Values for the subsistence catch of blackfish, burbot, northern pike, and saffron cod were estimated using relative contribution rates calculated from household harvests reported by R.J. Wolfe (1981). Catches of smelt and starry flounder were not reported and contribution rates for these species were set to 0, although' low levels of subsistence catch are known to be taken. The total average catch (commercial plus subsistence) was calculated and the abundance of each species in the catch was determined relative to the catch of chum salmon which had the highest harvest of all species.

3.4.6.3 Index of Sensitivity to Oil

An index of sensitivity of exposure to petroleum hydrocarbons or its weathered derivatives was developed by relating literature on oil impacts on Arctic fish to important species in the Yukon delta. Information regarding the species inhabiting the waters of the Yukon delta was found to be limited. Nevertheless, information for similar species was used and the probable impact of exposure to oil was evaluated for each of the major fish species. The relative level of sensitivity for each species was based on the assumption that all habitats had come into contact with substantial quantities of crude oil in a catastrophic event. No consideration was given to the probability that this event might occur, or to the relative probability of exposure of a given habitat in the event of a spill. Potential sensitivity levels were ranked as negligible, low, medium, or high, and were assigned a corresponding numerical ranking from 1 to4.

3.4.6.4 Index of Relative Impact

An index of relative impact was developed for each habitat for each month and for the entire season using the indices of abundance, duration of occurrence, contribution to the local community, and sensitivity to spilled oil. The values for abundance and duration of occurrence were multiplied together resulting in a measure of habitat use for each species by month and habitat. Amatrix of community importance of the habitats with respect to the local commercial and subsistence fisheries was created by multiplying the value in the habitat use matrix just described with the previously determined community importance values. This matrix represents the relative values of each habitat to the community fisheries.

An index of relative impact was created by weighting the matrix just described by the sensitivity values assigned to each species, by summing the values across month and species, and by scaling the resulting values from 0 to 10. The equation is:

$$I_i = \frac{\sum_{jk} A_{ijk} * O_{ijk} * S_j * (C_j)}{\max_i \sum_{jk}[A_{ijk} * O_{ijk} * S_j * (C_j)]} * 10$$

Where, I_i = Impact index value of habitat i

A_{ijk} = Abundance rating of species j in habitat i during month k

O_{ijk} = Duration of occurrence value of species j in habitat i during month k

C_j = Community importance factor of species j

S_j = Sensitivity to oil ranking of species j

A second index of relative impact was created without regard to importance of species to the local community fisheries using the same methods but excluding C_j, the community importance factor.

4.0 RESULTS

4.1 HABITAT CHARACTERIZATION

As explained above in the overall study strategy, prior to initiation of the field program, the study area was stratified into thirteen potentially separate habitat types. This initial partitioning of the study area was based primarily on differences in elevation and location relative to the coast. These factors were expected to have the greatest influence on the extent of saltwater mixing, river flooding, water clarity, degree of tidal influence, and water velocities.

4.1.1 Minter Studies - Discrete Physical Measurements

Water quality measurements were conducted during December 6 through December 13, 1984 in conduction with fish sampling efforts. Six sites (Figure 3-1) located along the coast between the South Mouth and North Mouth, and four inland sites were occupied during this survey. Transportation to and from St. Mary's, the base of operations, was accomplished with a NOAA supplied and operated helicopter. Navigation and relocation of survey sites was achieved with the GPS navigation system on board the helicopter.

The survey sites were selected to sample a variety of different habitat types. These included freshwater and brackish water habitats, major distributaries, and sloughs. Water quality data collected at each survey site included the following: temperature, conductivity, salinity, dissolved oxygen, and water clarity. The results of the discrete winter measurements are summarized in Table 4-1.

TABLE 4-1

WATER DEPTH, TEMPERATURE , CONDUCTIVITY, SALINITY, DISSOLVED OXYGEN, AND WATER CLARITY DURING WINTER 1984 IN THE YUKON RIVER OELTA

Habitat Type	Location	Date	Time	Oepth (m)	Temperature (°C)	Conductivity (mmhos/cm)	Salinity (0/00)	D.O. (pm)	Clarity (visual)
Major Active Distributary	Nunaktuk Island, Middle Mouth	12-07-84	13:45	0	0	2.2	0.7	--	--
				1	0	2.2	0.7	--	--
				2	-0.3	13.0	13.5	--	--
				3	-0.3	13.8	14.4	--	--
Minor Active Distributary	Bugomowik Slough	12-08-84	13:00	0	-1.5	14.1	15.0	12.0	Slightly Turbid
				1	-1.5	15.5	16.7	12.2	--
				2	-1.5	15.3	16.7	12.2	--
Major Active Distributary	Caseys Channel East Side	12-09-84	11:45	0	0	0.1	0	13.2	Clear
				1	0	0.1	0	13.2	--
				2	0	0.1	0	13.5	--
				3	0	0.1	0	13.6	--
				4	0	0.1	0	13.8	.-
Minor Active Distributary	Elongozhik Slough	12-09-84	15:00	0	-1.0	12.6	13.8	12.8	Slightly Turbid
				1	-1.0	13.1	14.3	12.8	--
				2	-1.5	16.9	19.3	13.5	--
Minor Active Distributary	Okshokwewhik Slough	12-10-84	14:30	0	0	0.2	0	--	Clear
				1	0	0.2	0	--	--
				2	0	0.2	0	--	--
				3	0	0.2	0	--	..
				4	0	0.2	0	--	--
Major Active Distributary	Okwega Pass	12-11-84	12:45	0	0	0.1	0	13.3	Clear
				1	0	0.1	0	13.7	--
				2	0	0.2	0	13.8	--
Major Active Distributary	Kwikpuk, Kwikpuk Pass	12-13-84	14:15	0	0	0.1	0	--	Clear
				1	0	0.1	0	--	--
				2	0	0.1	0	--	--
				3	0	0.1	0	--	--
Major Active Distributary	Akulurak Pass, east of Sunshine Bay	12-11-84	16:15	0	0	0	0	10.5	Clear
				1	0	0.1	0	12.0	--
				2	0	0.1	0	12.0	--
Major Inactive Distributary	Kwemeluk-Kanelik Jet	12-12-84	15:10	0	0	0.4	0	14.0	Clear
				1	0	0.6	0	12.8	--
				2	0	0.6	0	12.3	--
Minor Active Distributary	Black River	12-12-84	13:55	0	0	0.5	0	14.0	Clear
				1	0	0.8	0	13.4	..
				2	0	7.7	12.5	13.2	..
				3	0	8.7	14.1	14.2	--

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4.1.2 Summer Studies - Discrete Physical Measurements

A summary of summer water quality conditions within each habitat is presented in Table 4-2. Water quality conditions (temperature, salinity, conductivity, and Secchi depth) are further delineated by sampling date and habitat in Tables 1 and 2 in Appendix A. Routine measurements of temperature and salinity were the primary physical measurements used to describe conditions in each habitat. Electrical conductivity measurements were utilized when describing habitats which were primarily freshwater in character.

4.1.3 Sumner Studies - Continuous Recorders

Continuous recording instrumentation was deployed at five locations in the study area (see Figure 3-3). Instrumentation consisted of three Aanderaa RCM-4's and two SeaData CTDR-2A's which were bottom mounted. These recording gauges measured pressure, temperature, and conductivity. Sampling locations included sites at the mouths of the three major distributaries and at two inland locations. One of the inland sites near Emmonak was lost as a result of slumping of the river bank. All other stations were recovered in good condition. Instrumentation was deployed in mid-June and retrieved in mid to late September.

The highest salinity that was recorded at any of these sites wasO.2 ppt; therefore no plots were produced for this parameter. This salinity maximum occurred on 1-2 September 1985 during a positive storm surge event which was recorded at all of the recording meters.

Temperatures at all of the meters were very highly correlated throughout the whole sampling period as seen in Figure 4-1. Maximum difference in temperatures between all meters was less than 1°C for the same sampling time. At the time of deploymentof the first meter on 11 June 1985 water temperature in the river was 10.O”C. Temperatures steadily increased through June and July reaching a maximum of over

TABLE 4-2

SUMMARY OF WATER QUALITY CONDITIONS WITHIN HABITATS DURING SUMMER 1985 IN THE YUKON RIVER DELTA

Water Quality Paramter	Habitat: Delta Front	Mid-Delta Platform	Inner Delta Platform	Mudflats	Tidal Slough	Inter-Island Channel	Major Act. Distributary	Minor Act. Distributary	Major Inact. Distributary	Minor Inact. Distributary	Connetted Lake	Lake Outlet Channel	Land-locked Lake	Overall
Water Depth (m)														
mean	7	8	2	1	1	9		2	1	1	1	1	1	
range	6-9	4-10	2-3	0-1	0-2	5-15	1:6	2	1	1-2	1	1	1	
Conductivity (mmhos/cm)														
Surface mean	10.4	0.6	0.8	1.6	1.8	0.7	0.1	0.1	0.2	0.2	0.1	0.1	0.1	1.0
Surface range	1.0-23.9	0.1-1.5	0.0-3.5	0.2-6.1	0.1-3.7	0.0-7.9	0.0-0.3	0.1	0.1-0.4	0.0-0.3	0.1	0.0-0.1	0.0-0.1	0.0-23.9
Bottom mean	20.0	0.9	0.5			0.4	0.2	0.1						2.3
Bottom range	1.0-29.5	0.0-3.4	0.1-1.9			0.0-1.3	0.0-0.3	0.1						0.0-29.5
Temperature (°C)														
Surface mean	12.4	14.8	14.6	11.7	10.5	14.6	15.8	13.5	12.5	14.1	13.7	12.0	10.5	13.5
Surface range	9.0-15.0	10.0-19.0	12.0-18.0	5.0-21.0	6.0-18.0	9.0-19.0	8.0-20.0	12.0-15.0	9.0-16.0	10.0-19.0	13.0-15.0	12.0	10.0-11.0	5.0-21.0
Bottom mean	10.6	14.7	12.8			14.7	16.0	11						14.7
Bottom range	4.0-15.0	9.0-19.0	12.0-13.0			9.0-19.0	11.0-20.0	11						4.0-20.0
Salinity (ppt)														
Surface mean	6.5	0.3	0.4	0.9	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0		0.5
Surface range	0.5-15.8	0.0-0.8	0.0-2.0	0.0-3.6	0.0-2.1	0.0-0.6	0.0-0.1	0.0	0.0-0.2	0.0-0.1	0.0	0.0	0.0	0.0-15.8
Bottom mean	13.2	0.4	0.2			0.1	0.0	0.0						1.4
Bottom range	0.5-19.9	0.0-1.9	0.0-1.0			0.0-0.7	0.0-0.1	0.0						0.0-19.4
Secchi (depth cm)														
mean	70.0	14	13	15	27	16		75	82	120	27	10	125	47
range	20-120	10-20	10-20	10-30	10-60	10-20	1::20	60-90	40-120	50-220	20-30	10	120-130	10-220

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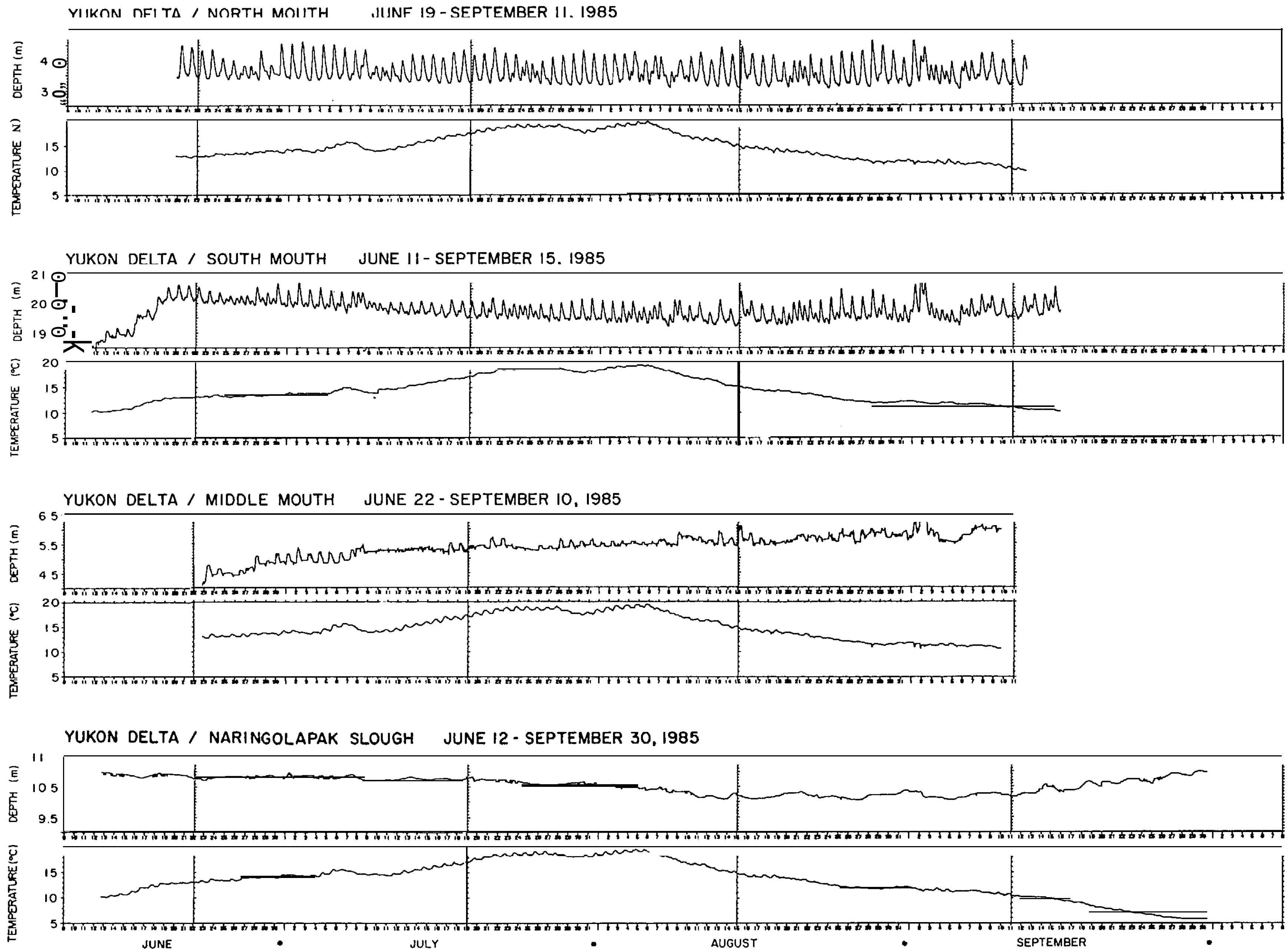

Figure 4-1. Temperature and Total Water Depth Time Series Plots for the Yukon River Delta.

19°C at all meters on 5 August. Water temperature then began to decline quickly, dropping to 14.0°C on 16 August. Temperatures continued to decline at all meters through August and September reaching a minimum of 5.7*C at Naringolapak Slough on 30 September, which was the location of the last instrument to be retrieved.

Diurnal water temperature fluctuations occurred at all four meters to different degrees as a result of warm air temperatures and high insolation during the morning and afternoon hours. The depth of each meter seemed to be the governing factor of whether the instrument measured large diurnal fluctuations in water temperature. The instrument which was deployed in 20 meters of water at South Mouth showed the least amount of fluctuation with less" than a 0.2°C daily temperature oscillation. Similarly the meter which was deployed at Naringolapak Slough near the Head of the Passes in 11 meters of water, showed smaller diurnal temperature fluctuations than the instruments at either the Middle or North Mouth sites which were deployed in approximately 5 meters of water. Maximum daily fluctuations at these two locations were 1.5°C. Diurnal fluctuations were greatest in June and July during periods of increasing water temperature, declining in August along with the fall in water temperature.

Total water depth is also depicted in Figure 4-1 along with water temperature. The total water depth was then decomposed into tide and surge level series for the meters located near the coast according to procedures outlined in the Methods and Materials section of this report. The inland meter at Naringolapak Slough did not measure any tidal oscillations in the water level as it was located 50 km from the coast, which was too far upstream to be influenced by tidal forcing. The only surge level event at this inland site which correlates with the coastal instrumentation is that which occurred on September 1 and 2. Water level increased 0.2 m for a period of48 hours then returned to the previous level following the surge event. Winds during this period ranged from 10 to 23 knots from the southwest at Emmonak. Surface weather observations at Emmonak were only taken for a 12 hour period each day which made cross-correlations with physical oceanographic parameters impossible.

Water level at the Naringolapak Slough site stayed fairly steady through June and most of July. The water level began to decline in late July with a few short term reversals which can probably be related to increased river discharge due to rain. In early September the water level began to increase, rising 0.9 m by the end of the month. This increase in discharge during September can probably be attributed to the higher rainfall during the fall in the Alaskan interior.

Surge level data from the three coastal locations at the mouths of the main distributaries are depicted in Figure 4-2 along with the tidal time series. Surge levels at the South Mouth and the North Mouth were found to correlate quite well, while the measured surge at the Middle Mouth had a lower correlation with the other two. The Middle Mouth meter shows a steady increase in water level through the whole period of record which was believed to be caused by the meter sliding down the steep bank along which it was moored. Also, most of the water level fluctuations at the Middle Mouth are much smaller than those measured at the other sites. The South Mouth meter also shows a vertical displacement during the first week of measurement resulting from the mooring sliding deeper into the river channel. The mooring seems to have stabilized after that point since no other anomalous vertical changes were seen in the record. Since high quality meteorological time series data were not available for cross-correlation purposes, surge levels could not be analyzed to determine wind speed and direction influences.

Tide levels depicted in Figure 4-2 indicate large differences in both range and type of tide between stations. The tides at the North Mouth were found to be almost entirely diurnal with the semi diurnal component

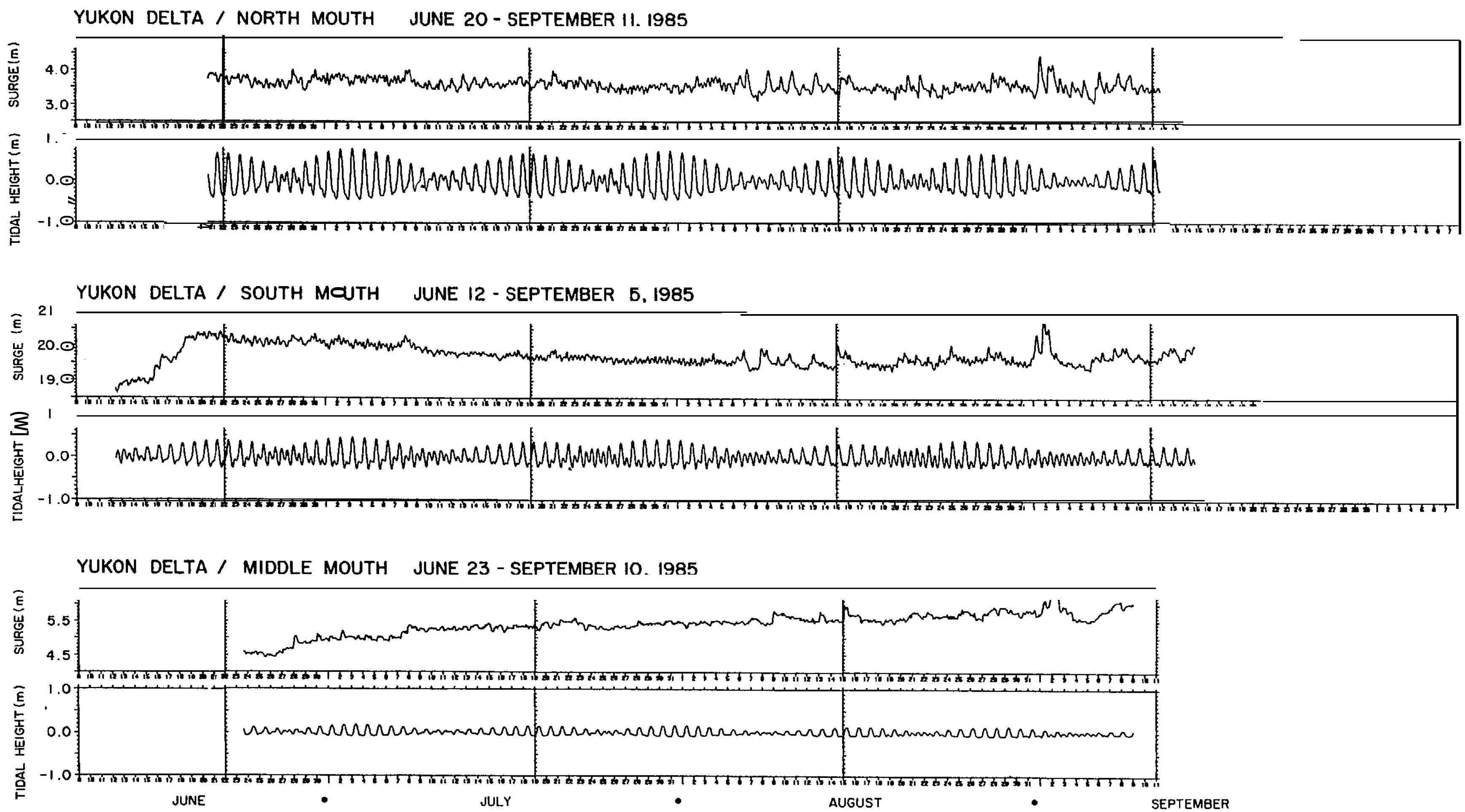

Figure 4-2. Surge Level and Tidal Level Time Series Plots for the Yukon River Delta.

being very small. Maximum range of the tide during the period of record was 1.2 m at the North Mouth. Large differences between the ranges of spring and neap tide can be seen with a mean neap tide range of only 0.3 to 0.4 m. Tides at the Middle Mouth were much smaller in amplitude with a maximum range of 0.25 m. The tides at the Middle were also mainly diurnal but becoming more mixed. The tidal record from the South Mouth pressure gauge show mixed tides with a large diurnal inequality. Maximum range was 0.75 m at the South Mouth. These results agree with the Tide Tables for the region (NOAA/NOS 1984) which show a diurnal range of 4.0 ft for Apoon Mouth (North Mouth), 2.7 ft for Kawanak Pass (Middle Mouth), and 2.3 ft for Kwikluak Pass (South Mouth). The tide tables also indicate a change from mixed tides in the southern delta region to diurnal tides in the northern portion bordering Norton Sound which is also diurnal.

Principal tidal constituents for the three stations are shown in Table 4-3. The diurnal components can be seen to be much more important at the North Mouth where the amplitudes of the principal solar (01) and lunar (K1) diurnal constituents are both larger than the principal lunar (M2) semidiurnal constituent. At the South Mouth the M2 constituent has the largest amplitude.

4.2 CATCH SUMMARY - WINTER SURVEY

4.2.1 Distribution and Abundance

The winter survey resulted in the capture of85 fish comprising 9 species (Table 4-4). Anadromous species (i.e., sheefish, whitefish, cisco, and smelt) accounted for 86 percent of the total catch of which sheefish and boreal smelt were the most abundant. Freshwater fish (i.e., northern pike and burbot) and one marine species (fourhorn sculpin) accounted for 13 percent and 1 percent of the catch, respectively.

TABLE 4-3

PRINCIPAL TIDAL CONSTITUENTS, YUKON RIVER DELTA

Station	Constituent	Frequency Cycles/Day	Amplitude Meters	Phase, * Degrees
North Mouth	01	0.92954	0.20577	159.41
	K1	1.00274	0.30478	-20.25
	N2	1.89598	0.04030	-59.76
	M2	1.93227	0.13916	133.15
	S2	2.00000	0.01268	-176.78
	M4	3.86455	0.01431	-174.97
	M6	5.79682	0.00008	-10.44
Middle Mouth	01	0.92954	0.04665	147.50
	K1	1.00274	0.06614	-34.67
	N2	1.89598	0.00838	-105.80
	M2	1.93227	0.03477	113.02
	S2	2.00000	0.00561	-105.77
	M4	3.86455	0.00739	70.56
	M6	5.79682	0.00094	13.44
South Mouth	01	0.92954	0.10133	121.71
	K1	1.00274	0.14973	-71.79
	N2	1.89598	0.03954	-145.09
	M2	1.93227	0.13169	70.26
	S2	2.00000	0.01142	-12.84
	M4	3.86455	0.02060	64.61
	M6	5.79682	0.00285	43.00

* Note: Phase in degrees referenced to time = 000 Jan. 1, 1985, ADST.

TABLE 4-4

SUMMARY OF GILL NET CATCH DURING DECEMBER 1984
IN THE YUKON RIVER DELTA

Habitat	Station	Effort (Hrs)	Species[a/] SHE	HBW	BRW	BRC	LSC	BSM	PIK	BUR	FHS	Total
Minor Active Distributary	Caseys Channel	23.25	1	--	--	--	--	--	--	--	--	1
Minor Active Distributary	Bugomowik Slough	24.00	--	--	--	--	--	--	--	--	--	0
Major Active Distributary	Nunaktuk Island	24.00	11	--	--	5	--	--	--	--	--	16
Minor Active Distributary	Elongozhik Slough	22.00	--	--	--	--	--	9	--	--	1	10
Minor Active Distributary	Okshokwewhik Pass	22,83	1	3	--	--	--	--	--	1	--	5
Major Active Distributory	Okwega Pass	22.42	1	2	1	--	--	--	--	3	--	7
Major Active Distributary	Kwikpuk, Kwikpuk Pass	25.92	--	1	--	--	--	.-	1	2	--	4
Major Active Distributary	Near Akularak Pass	20.58	--	--	--	--	4	--	--	2	--	6
Major Inactive Distributary	Kuemeluk-Kanelik Jet.	20.83	4	--	1	1	--	---	--	--	--	6
Minor Active Distributary	Black River	21.42	9	--	--	2	1	16	1	1	--	30
			27	6	2	8	5	25	2	9	1	85

a/ SHE - Sheefish
HBW - Humpback whitefish
BRW - Broad whitefish
BRC - Bering cisco
LSC - Least cisco
BSM - Boreal smelt
PIK - Northern pike
BUR - Burbot
FHS - Fourhorn sculpin

Sheefish, Bering cisco, least cisco, northern pike and burbot were caught at sites with either brackish or freshwater (Table 4-1 and Table 4-4). Boreal smelt and fourhorn sculpin were only caught at sites with brackish water, and whitefish (i.e., humpback and broad) were only caught at sites with freshwater. Sheefish were the most widely distributed of all species. The greatest diversity of species was found at the Black River site which had stratified salinity levels, Differences in abundance among species and stations were not identified because the number of samples was too small for a meaningful analysis.

4.2.2 Size Composition

The number of fish caught. during the winter survey was not sufficient for a meaningful length-frequency analysis. However, a summary of fish lengths for each species is listed in Table 4-5 . Most of the fish caught were large individuals which indicates that adult populations utilize both coastal and inner delta habitats during the early winter. Smaller individuals of all species except least cisco and boreal smelt were absent in the catch. Small fish may utilize this habitat, but were not caught because of size selectivity of the gear.

4.3 CATCH SUMMARY - SUMMER SURVEY

4.3.1 Effort

Sampling effort was partitioned among four synoptic surveys of the entire delta region and a series of repetitive surveys at several selected study sites (Table 4-6). The first synpotic survey extended from June 14 through July 3, and included 31 sample sites. This survey provided an initial understanding of the diversity of aquatic habitats in the Yukon Delta and resulted in the improvement of sample

TABLE 4-5

MEAN, STANDARD DEVIATION, AND RANGE OF FISH LENGTHS FOR FISH CAUGHT IN GILL NETS DURING DECEMBER 1984 IN THE YUKON RIVER DELTA

Species	Number	Fork Length (mm)		
		Mean	S.D.	Range
Sheefish	27	575.9	137.1	306-790
Humpback whitefish	6	326.8	29.9	279-367
Broad whitefish	2	303.5	0.7	303-304
Bering cisco	8	347.2	31.9	279-378
Least cisco	5	155.0	80.3	108-296
Boreal smelt	25	154.2	18.4	133-204
Northern pike	2	502.5	130.8	410-595
Burbot	9	501.3	129.7	390-774
Fourhorn sculpin	1	165.0	--	--

TABLE 4-6

SUMNARY OF SAMPLING EFFORT BY FISHING GEAR[a/], STATION, ANO BY OATE DURING THE SUMMER 1985 SURVEY OF THE YUKON RIVER OELTA

Oate	Station 1 (1-1, 1-2)	Station 2 (2-1, 2-2)	Station 3 (3-2, 3-3, 3-5, 3-6)	Station 4 (4-2, 4-4, 4-5, 4-6)	Station 5 (5-1 … 5-14)	Station 6 (6-2, 6-3)	Station 7 (7-2 … 7-10)	Station 8 (8-2)	Station 9 (9-1, 9-2)	Station 10 (10-1, 10-2, 10-3)	Station 11 (11-1)		Station 13 (13-1)
6/1 4					,L G		1						
6/1 5					L								
6/16		P			G								
6/1 7		P									G		
6/18*													
6/19						P		,1		G,1			
6/20							HH			1			
6/21	P				T								
6/22							H	1					
6/23					L L G,1								
6/24*													
6/25		P											
6/26							H						
6/27										0			
6/28							HH						
6/29*													
6/30		P								0			
7/1			2	1									
7/2							H				G,		
7/3										0			
7/4													
7/5									G	0			
7/6									G,1	0			
7/7							H						
7/8					L								
7/9					T		H		1	0			
7/lo*													
7/11													
7/12							HH						
7/1 3*													
7/14										0			
7/15													
7/16										0			
7/1 7							H						
7/18		P											
7/1 9													
7/20*													
7/21						P	H H						
7/22	P						H						
7/23										0			
7/24				1	T								
7/25													
7/26	P	P											
7/27*													
7/28'													
7/29										0			
7/30				1	T								
7/31							H						

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TABLE 4-6 (Continued)

SUMMARY OF SAMPLING EFFORT BY FISHING GEAR[a/], STATION, AND DATE DURING THE SUMMER 1985 SURVEY OF THE YUKON RIVER DELTA

Date	Station 1 (1 2 3)	2 (2)	3 (2 3 5 6)	4 (1 2 4 5 6)	5 (2 3 4 5 6 7 8 9 10 11 12 13)	6 (2 3)	7 (2 3 4 5 6 7 8 9)	8 (1 2)	9 (2)	10 (1 2 3)	11 (1 2)	12/13 (1)
8/1							H			0		
8/2							H					
8/3							H					
8/4			2	1	T							
8/5					T							
8/6							H					
8/7				1	T		H			0		
8/8				1	T							
8/9*												
8/10	P											
8/11		P										
8/12						P	H			0		
8/13	P											
8/14			2			P						
8/15							H					
8/16	P											
8/17*												
8/18										0		
8/19			2									
8/20				1	T							
8/21				1								
8/22							H			0		
8/23												
8/24									;,			
8/25										0 0 0 0		
8/27				1	T							;,
8/28				1	T							
8/29										0		
8/30							H					
8/31 *												
9/2*												
9/3*												
9/4		P										
9/5												
9/6*												
9;7*												
9/8										0		
9/9		P										
9/10	P											
9/11*												
9/12			2		T							
9/13						P	H					
9/14*												
9/15*												
9/16				1	T							
9/1 7				1	T							
9/18							H					

a/ Gear Codes: 1 = single-body fyke net; 2 = double body fyke net; G = gill net; H = hook seine; L = beach seine; O = lake outlet trap; P = purse seine; T = tidal slough trap; * = no effort.

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procedures. Subsequent synpotic surveys were shorter in duration (i.e., July 17 - July 26, August 2 through August 14, and September 4 - September 18) and included a lesser number of stations. Sites excluded from the latter surveys were either replicates of similar habitat in the same vicinity or had poor access.

In the interim between synpotic surveys, stations 2-1, 6-1, 7-8, and 10-1 were sampled on an intermittent but more frequent basis (Table 4-6). Also samples were collected one time from a number of lesser important habitats (e. g., stations 9-2, 10-2, 12-1, and 13-1) which were not sampled during the synpotic surveys.

Table 4-6 indicates the variety of fishing gear used to sample the various habitats on the Yukon Delta. The large variability in physical conditions (i.e., depth, current, and tide) among different habitats made it necessary to deploy different gear in each habitat. Since each gear had a different catch efficiency and there was very little overlap of gear types in each habitat it was not possible to standardize CPUE between gear. Consequently, comparisons of effort and catch among stations and dates could only be made within each gear type. A summary of effort for each gear is shown in Table 4-7.

4.3.2 Species Composition and Catch by Gear

The summer survey resulted in the capture of 32 species of fish comprising 13 anadromous species, 9 freshwater species, and 10 marine species (Table 4-8). The humpback, broad, and round whitefish were considered as freshwater species in spite of the fact that many were collected from brackish waters in nearshore areas of the delta. The char were listed as _Salvelinus malma_ although it was possible that the specimens caught were _Salvelinus alpinus_. Bering cisco and arctic cisco were very difficult to differentiate in the field. Therefore both species were listed as caught but the majority of the catch was recorded as Bering cisco. The pricklebacks were identified as _Lumpenus fabricii_ and L. _mackayi_ (Rae Baxter, personal communication).

TABLE 4-7

NUMBER OF GEAR HAULS OR GEAR SETS COLLECTED DURING SUMMER 1985 IN THE YUKON RIVER DELTA

Habitat	Gear									
	Purse Seine	Hook Seine	Beach Seine	Tidal Net	Gill Net	Single Body Fyke	Double Body Fyke	Lake Outlet Trap	All	Percent
Delta Front	13								13	(5)
Mid Delta Platform	20								20	(8)
Inner Delta Platform							6		6	(2)
Mudflats						19			19	(8)
Tidal Slough			7	38	3	1			49	(19)
Inter-Island Channels					1	1			2	(<1)
Major Active Distributary	30								30	(12)
Minor Active Distributary		53				2			55	(22)
Major Inactive Distributary					2	1			3	(1)
Minor Inactive Distributary					2	3			5	(2)
Connected Lake					3	5			8	(3)
Lake Outlet Channel					1	2		38	41	(16)
Land-Locked Lake					1	1			2	(<1)
All	63	53	7	38	13	35	6	38	253	
(Percent)	(25)	(21)	(3)	(15)	(5)	(14)	(2)	(15)		

TABLE 4-8

LIST OF COMMON AND SCIENTIFIC NAMES OF FISH SPECIES CAUGHT DURING THE WINTER 1984 AND SUMMER 1985 SURVEYS OF THE YUKON RIVER DELTA

Common Name	Scientific Name
Anadromous	
Chinook Salmon	*Oncorhynchus tshawytscha*
Chum Salmon	*Oncorhynchus keta*
Coho Salmon	*Oncorhynchus kisutch*
Pink Salmon	*Oncorhynchus gorbuscha*
Dolly Varden/Arctic Char	*Salvelinus malma*
Sheefish	*Stenodus leucichthys*
Arctic Cisco	*Coregonus autumnalis*
Bering Cisco	*Coregonus laurettae*
Least Cisco	*Coregonus sardinella*
Boreal Smelt	*Osmerus eperlanus*
Threespine Sticklebacks	*Gasterosteus aculeatus*
Ninespine Sticklebacks	*Pungitius pungitius*
Arctic Lamprey	*Lampetra japonica*
Freshwater	
Humpback Whitefish	
Broad Whitefish	
Round Whitefish	
Pond Smelt	
Longnose Sucker	
Northern Pike	
Burbot	
Alaska Blackfish	
Trout-Perch	
Marine	
Starry Flounder	
Arctic Flounder	
Saffron Cod	
Arctic Cod	
Fourhorn Sculpin	
Pacific Herring	
Capelin	
Bering Poacher	
Pricklebacks	
Whitespotted Greenling	

Most fish (i. e., 33 percent) were caught in the single-body fyke net, but the largest number of species (84 percent) were caught in the purse seine (Table 4-9). Whitefish accounted for the largest proportion of the catch (36 percent) and were caught with all types of gear. Juvenile salmon only accounted for approximately 3 percent of the total catch and were most frequently caught with active types of gear (i.e., purse seine and hook seine).

4.3.3 Catch by Habitat

Fish collected from coastal mudflats and tidal sloughs accounted for more than 53 percent of the total catch during the summer survey (Table 4-10). The portion caught from other habitats were: active distributaries (17 percent), lake outlet channel (12 percent), delta front (11 percent), delta platform (7 percent), and all remaining habitats (less than 1 percent). The greatest number of species were caught in the tidal slough (22 species) most of which were comprised of anadromous fish (12 species). The active distributaries, coastal habitats, and offshore habitats all had 15 or more species. The inactive distributaries and lake associated habitats had 11 or less species. Anadromous fish were present in all habitats. Freshwater species were present in all habitats except the delta front and mid-delta platform. Marine fish were concentrated in the coastal and offshore habitats except for flounder and the fourhorn sculpin which also occurred in a minor active distributary.

4.4 SPECIES CHARACTERIZATION - SUMMER SURVEY

Descriptions of the distribution, timing, abundance, and size composition of selected fish species are presented in this section. Species of fish that occurred in low numbers or were not important to the commercial and subsistence fishery were omitted. However, a summary of the catch per unit effort for all species, including those omitted from this section, is presented in Appendix B. Length-frequency tables for selected species grouped by habitat and time period are given in Appendix C.

TABLE 4-9
NUMBER OF FISH CAUGHT BY SPECIES AND GEAR, AND NUMBER SPECIES CAUGHT BY GEAR
DURING SUMMER 1985 IN THE YUKON RIVER OELTA

	Catch 8y Gear									
Species	Beach Seine	Lake Outlet Trap	Tidal Net	Gill Net	Purse Seine	Single Fyke Net	Double Fyke Net	Hook Seine	Al 1	Percent
Chinook Salmon					15	9	4	1	29	0.1
Chum Salmon	1	29	3	4	310	10	129	392	878	2.0
Coho Salmon					1			1	2	<0.1
Pink Salmon	6				29	3	16	47	101	0.2
Unidentified Mixed Pink and Chum						13		256	269	0.6
Unidentified Dolly Varden/Arctic Char					1	1			2	<0.1
Sheefish	8	648	441	29	308	1,372	134	241	3,181	7.1
Humpback Whitefish	119	2	394	89	3	215	14	33	869	1.9
Broad Whitefish	10	3	41	18	1	33		5	111	0.2
Round Whitefish						1			1	<0.1
Unidentified Whitefish		1,448	2,908		219	9,946	27	387	14,935	33.4
Arctic Cisco			1	1					2	<0.1
Bering Cisco	1	4	13			221	4	2	245	0.5
Least Cisco	17	25	229	41	3	331	12	33	691	1.5
Unidentified Cisco		221	1,327	2	208	1,160	42	120	3,080	6.9
Unidentified Whitefish and Cisco	198	2,504	514		638	52		1,833	5,739	12.9
Boreal Smelt			10		3,226	39	340	35	3,650	8.2
Pond Smelt			17		416	16	29	75	553	1.2
Unidentified Smelt					99		156	1,614	1,869	4.2
Threespine Sticklebacks			1			1			2	<0.1
Ninespine Sticklebacks	3	234	1,780		561	222	28	98	2,926	6.6
Arctic Lamprey	2				7		2	21	32	0.1
Unidentified Lamprey								38	38	0.1
Longnose Sucker	2	5	58	2	1	25		13	106	0.2
Northern Pike		39	3	40	1	16		13	112	0.2
Burbot	18	86	65	3	22	90	51	953	1,288	2.9
Blackfish		61		12		36		1	110	0.2
Trout-Perch		8						1	9	<0.1
Starry Flounder	3		93		6	379	9	12	502	1.1
Arctic Flounder			477		51	383	587	1	1,499	3.4
Saffron Cod		305	178		563	282	80		1,408	3.2
Arctic Cod					1					<0.1
Fourhorn Sculpin			2		27	2	90	1	12:	0.3
Unidentified Sculpin							7		7	0.1
Pacific Herring					279				279	0.6
Capelin					3				3	<0.1
Bering Poacher					1				1	<0.1
Pricklebacks					3				3	<0.1
Whitespotted Greenling					3				3	<0.1
Unidentified Fish								3	3	<0.1
TOTAL NUMBER INDIVIDUALS	388	5,622	8,555	241	7,006	14,858	1,761	6,230	44,661	
TOTAL NUMBER SPECIES	12	13	18	10	27	22	16	21	32	

TABLE 4-10

NUMBER OF FISH CAUGHT BY SPECIES AND HABITAT, AND NUMBER OF SPECIES CAUGHT BY HABITAT DURING SUMMER 1985 IN THE YUKON RIVER DELTA

Species	Habitat: Delta Front	Mid-Delta Platform	Inner Delta Platform	Mudflats	Tidal Slough	Inter-Island Channel	Major Act. Distributary	Minor Act. Distributary	Major Inact. Distributary	Minor Inact. Distributary	Connetted Lake	Lake Outlet Channel	Landlocked Lake	All	Percent
Chinook Salmon		9	4	1			6	9						29	0.1
Chum Salmon	3	182	129	4	7		125	398		1		29		878	2.0
Coho Salmon							1	1						2	<0.1
Pink Salmon	12	4	16		6		13	50						101	0.2
unidentified Mixed Pink and Chum					13			256						269	0.6
Unidentified Dolly Varden/Arctic Char		1		1										2	<0.1
Sheefish	1	112	134	1,321	464		195	241	13	1	51	648		3,181	7.1
Humpback Whitefish			14	137	582		3	59	20	36	7	11		869	1.9
Broad Whitefish				26	59		1	5	12	6		2		111	0.2
Round Whitefish					1									1	<0.1
Unidentified Whitefish		2	27	9,943	2,934	2	217	387			1	1,422		14,935	33.4
Arctic Cisco					2									2	<0.1
Bering Cisco			4	221	18			2						245	0.5
Least Cisco		1	12	225	306		2	60	31	36	2	16		691	1.5
Unidentified Cisco	119	7	42	1,160	1,335		82	120		1		214		3,080	6.9
Unidentified Whitefish and Cisco	1	213		1	712		424	1,833	2		49	2,504		5,739	12.9
Boreal Smelt	2,958	251	340	20	11		17	53						3,650	8.2
Pond Smelt	380	3	29	16	17		33	75						553	1.2
Unidentified Smelt		93	156				6	1,614						1,869	4.2
Threespine Sticklebacks				1	1									2	<0.1
Ninespine Sticklebacks	378	178	2B	210	1,863		5	100		3	1	160		2,926	6.6
Arctic Lamprey	1	1	2		2		5	21						32	0.1
Unidentified Lamprey								38						38	0.1
Longnose Sucker				13	66		1	14	4	2	1	5		106	0.2
Northern Pike				1	5		1	13	2	9	30	51		112	0.2
Burbot			51	61	86		22	972	3		8	85		1,288	2.9
Blackfish								1			9	61	39	110	0.2
Trout-Perch								1				8		9	<0.1
Starry Flounder		6	9	377	98			12						502	1.1
Arctic Flounder	8	43	587	383	477			1						1,499	3.4
Saffron Cod	562	1	80	281	484									1,408	3.2
Arctic Cod	1													1	<0.1
Fourhorn Sculpin	2	25	90	1	3			1						122	0.3
Unidentified Sculpin			7											7	0.1
Pacific Herring	279													279	0.6
Capelin	3													3	<0.1
Bering Poacher	1													1	<0.1
Pricklebacks	3													3	<0.1
Whitespotted Greenling	3													3	<0.1
Unidentified Fish								3						3	<0.1
TOTAL NUMBER INDIVIDUALS	4,715	1,132	1,761	14,404	9,552	2	1,159	6,340	87	95	159	5,216	39	44,661	
TOTAL NUMBER OF SPECIES (Percent)	17 (11)	15 (3)	16 (4)	19 (32)	22 (21)	1 (<1)	15 (3)	21 (14)	7 (<1)	8 (<1)	8 (<1)	11 (12)	1 (<1)		

4.4.1 Juvenile Salmon

4.4.1.1 Distribution, Timing, and Abundance

Chinook Salmon

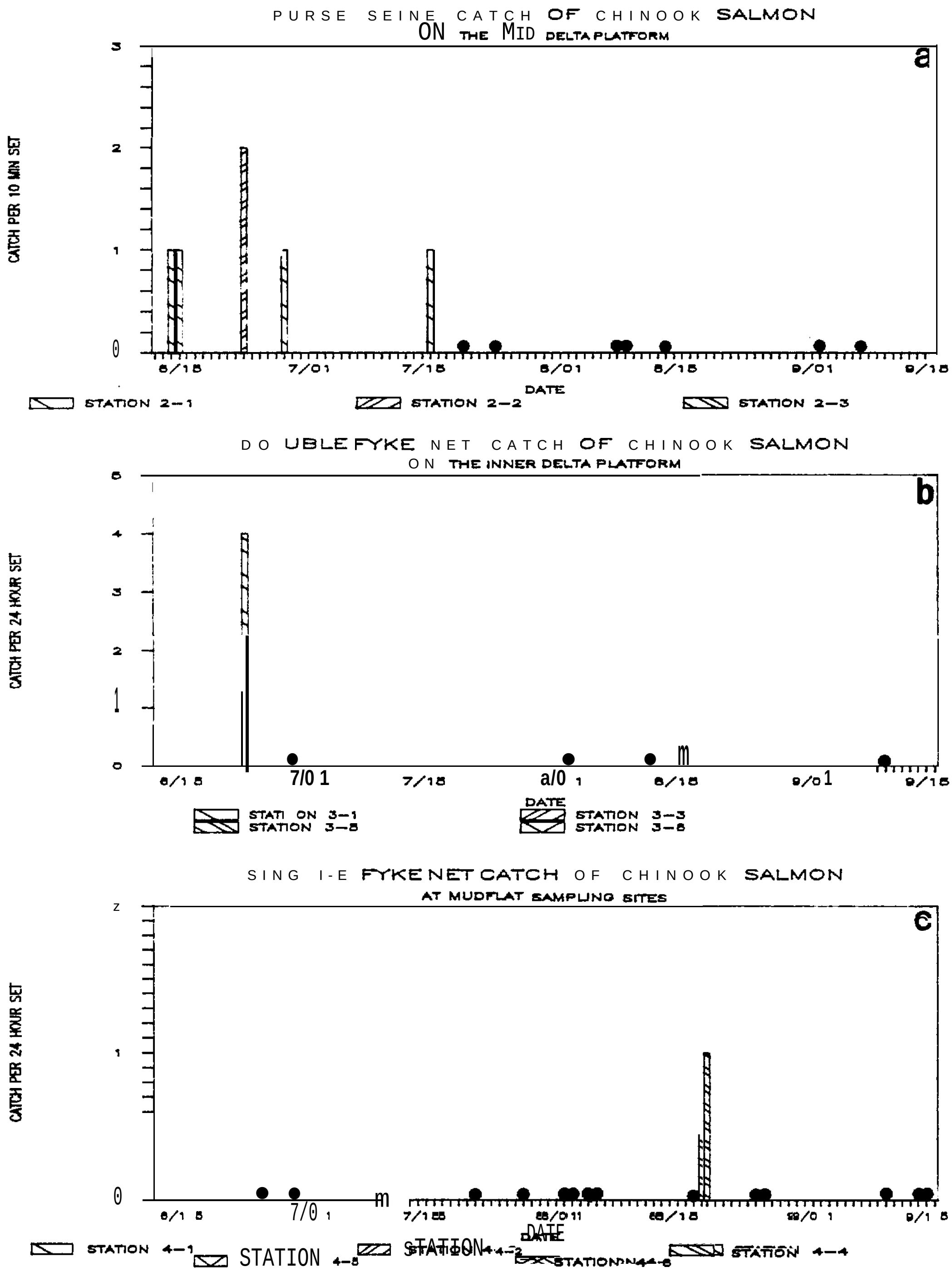
Catches of juvenile chinook salmon were small (29 fish) and only accounted for a 0.1 percent of the total catch (Table 4-10). Most of the fish were caught during late June in active distributary and delta platform habitats (Figure 4-3). A few fish were also caught in July and August, one of which occurred at Station 4-4 on the coastal mudflats.

Catches of chinook were too small for identification of any temporal patterns in the outmigration. However, this low abundance suggests the major portion of the outmigration may have preceded the period of sampling.

Chum Salmon

Chum salmon were the most abundant and most widely distributed of all salmon species (Table 4-10). Chum were caught at two stations in the delta front, three stations on the delta platform, five stations in coastal habitats, and almost all stations in active distributaries (Figure 4-4). Chum also occurred in a lake outlet channel and a major inactive distributary.

The greatest abundance of chum was observed during later June in active distributaries (Fig. 4-4f and 4-4g). Peaks in abundance also occurred at about the same time in the inner delta platform and delta platform stations (Fig. 4-4b and 4-4c). Abundance declined rapidly by early July in all habitats and low numbers of fish were caught



Fiqure 4-3. Catch Per Unit Effort of Chinook Salmon in (a) Mid Delta Platform, (b) Inner Delta Platform, and" (c) Mudfl at Sampling Sites.

(o) = Effort but no catch.

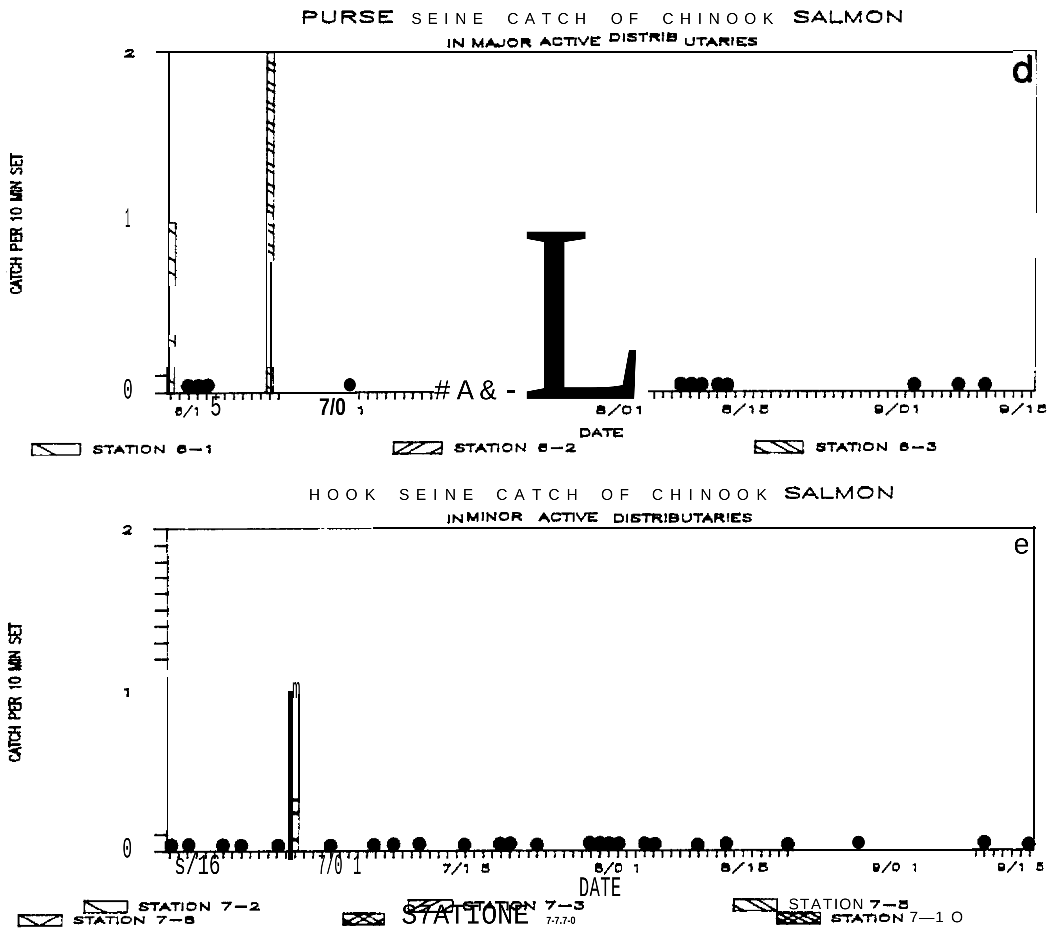


Figure 4-3. Catch Per Unit Effort of Chinook Salmon in (d) Major Active Distributaries and (e) Minor Active Distributaries.

(●) = Effort but no catch.

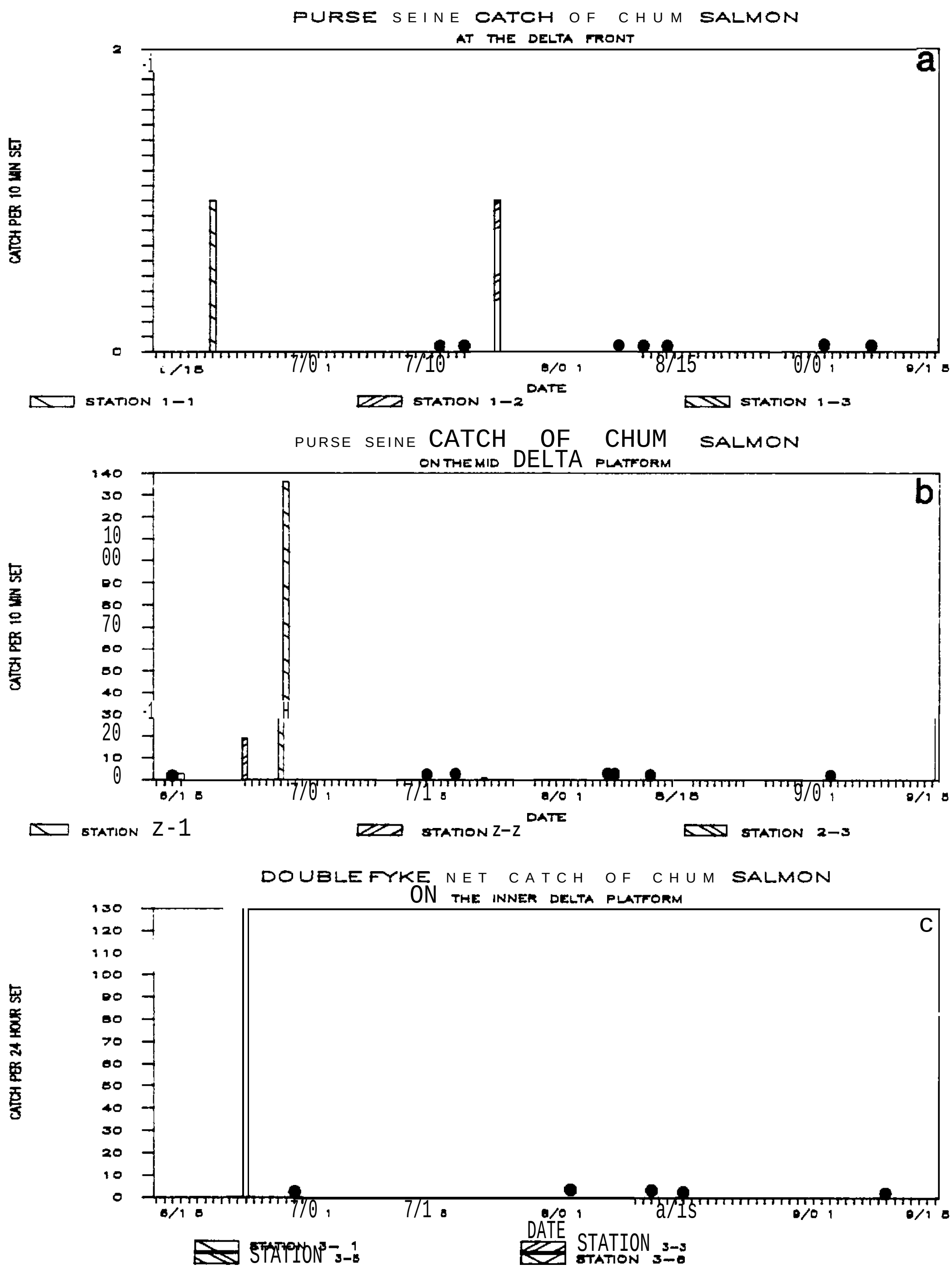


Figure 4-4, Catch Per Unit Effort of Chum Salmon in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform,

(●) - Effort but no catch

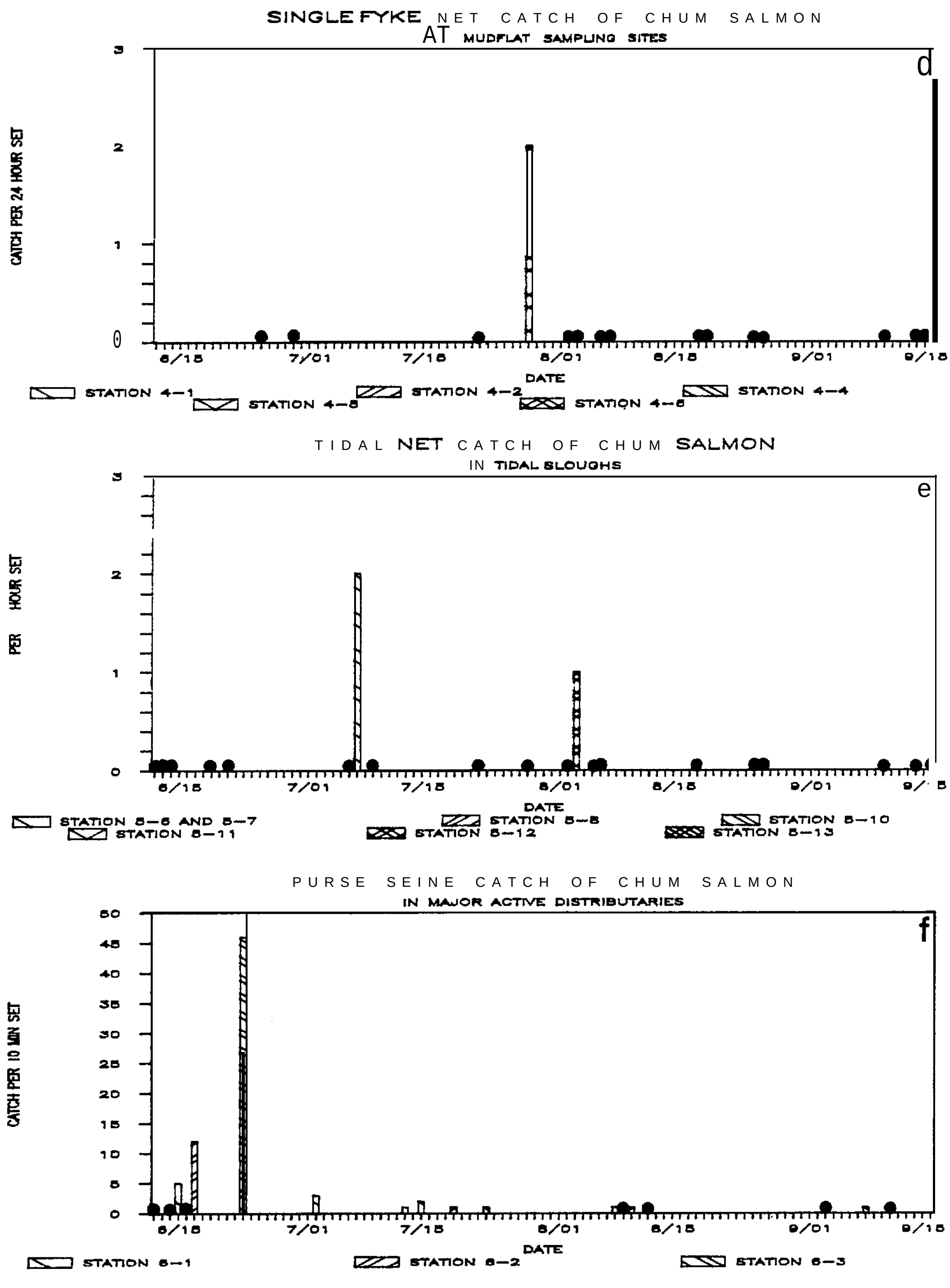


Figure 4-4. Catch Per Unit Effort of Chum Salmon in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Major Active Distributaries.

(●) - Effort but no catch

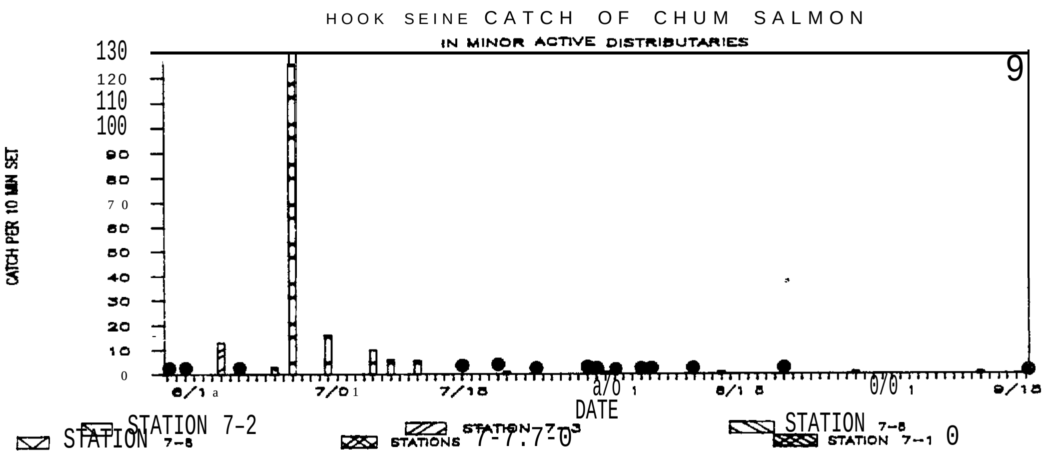


Figure 4-4. Catch Per Unit Effort of Chum Salmon in (g) Minor Active Distributaries.

(●) = Effort but no catch.

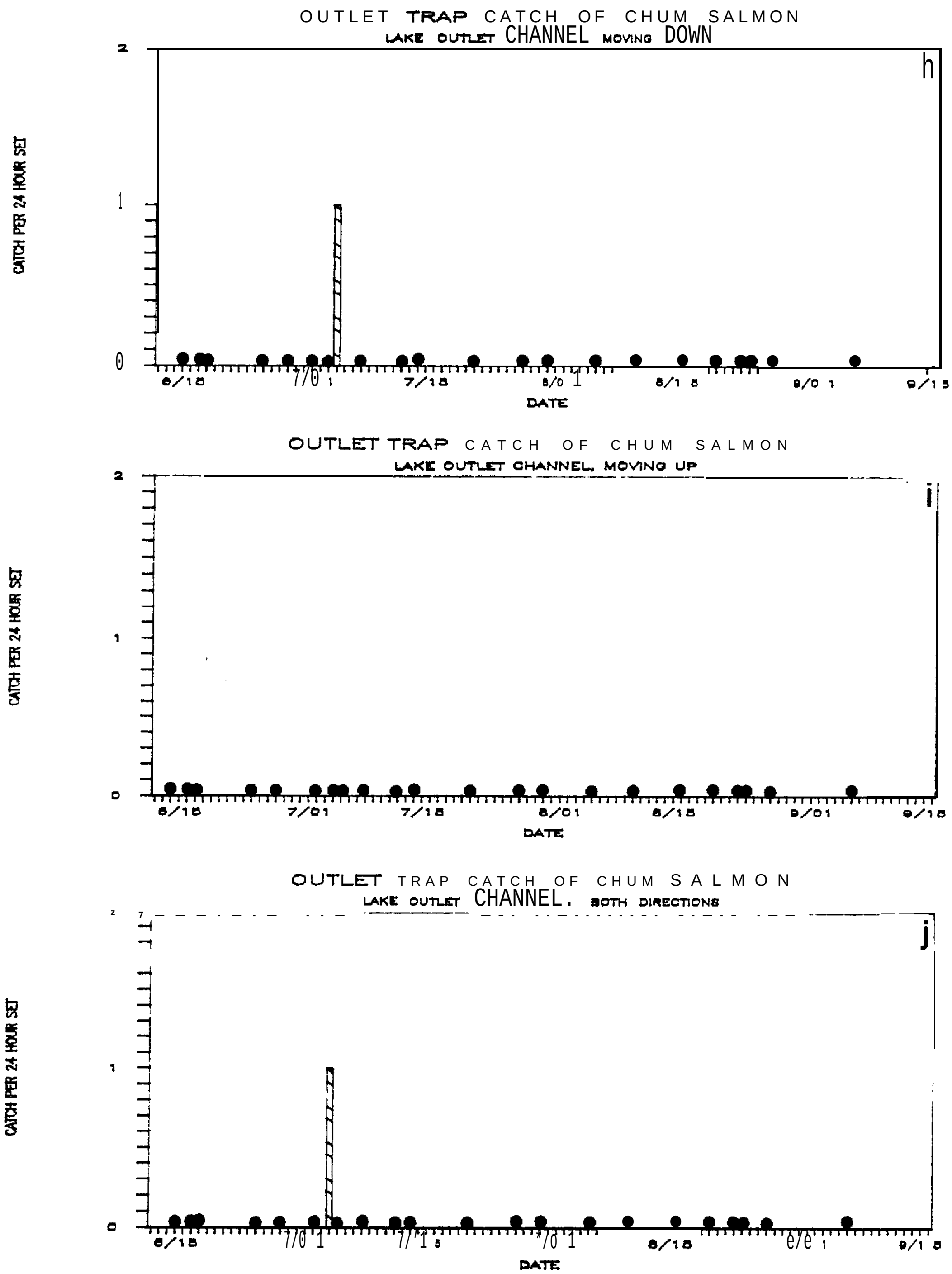


Figure 4-4. Catch Per Unit Effort of Chum Salmon in (h) Lake Outlet Channel Moving Down, (i) Lake Outlet Channel, Moving Up, and (j) Lake Outlet Channel, Both Directions.

(●) = Effort but no catch.

intermittently through the remainder of the summer. Only seven fish were caught in all coastal, delta platform and delta front habitats during July and early August. No chum were caught in any habitat except active distributaries during late August and September.

Coho Salmon

Only one juvenile coho salmon was caught. This fish was taken with a hook seine at Station 7-10 on July 25 (Appendix B, Table 5).

Pink Salmon

Juvenile pink salmon were the second most abundant species of salmon and were collected at 15 stations located in active distributary, tidal slough, delta platform, and delta front habitats. This distribution was similar to that observed for juvenile chum salmon except for the absence of pink salmon in mudflat or lake outlet channel habitats. The greatest abundance of pink salmon was observed in minor active distributaries and the greatest single catch (16 fish) occurred at the inner delta platform on June 25 (Figure 4-5c).

Pink salmon were caught primarily during late June (Figure 4-5). Juveniles were initially caught in the active distributaries immediate after sampling began. Catch rapidly peaked at all other habitats between June 17th to June 20th. Few fish were observed after July 1st and no fish were observed after August 2nd. This pattern of fish abundance suggests that pink salmon moved quite rapidly through the delta habitats to the delta front. The occurrence of the largest catches at the beginning of sampling suggests the outmigration was already in progress by June 14th. The peak in the smelt outmigration may have occurred prior to June 14th, since catches declined soon after sampling was begun.

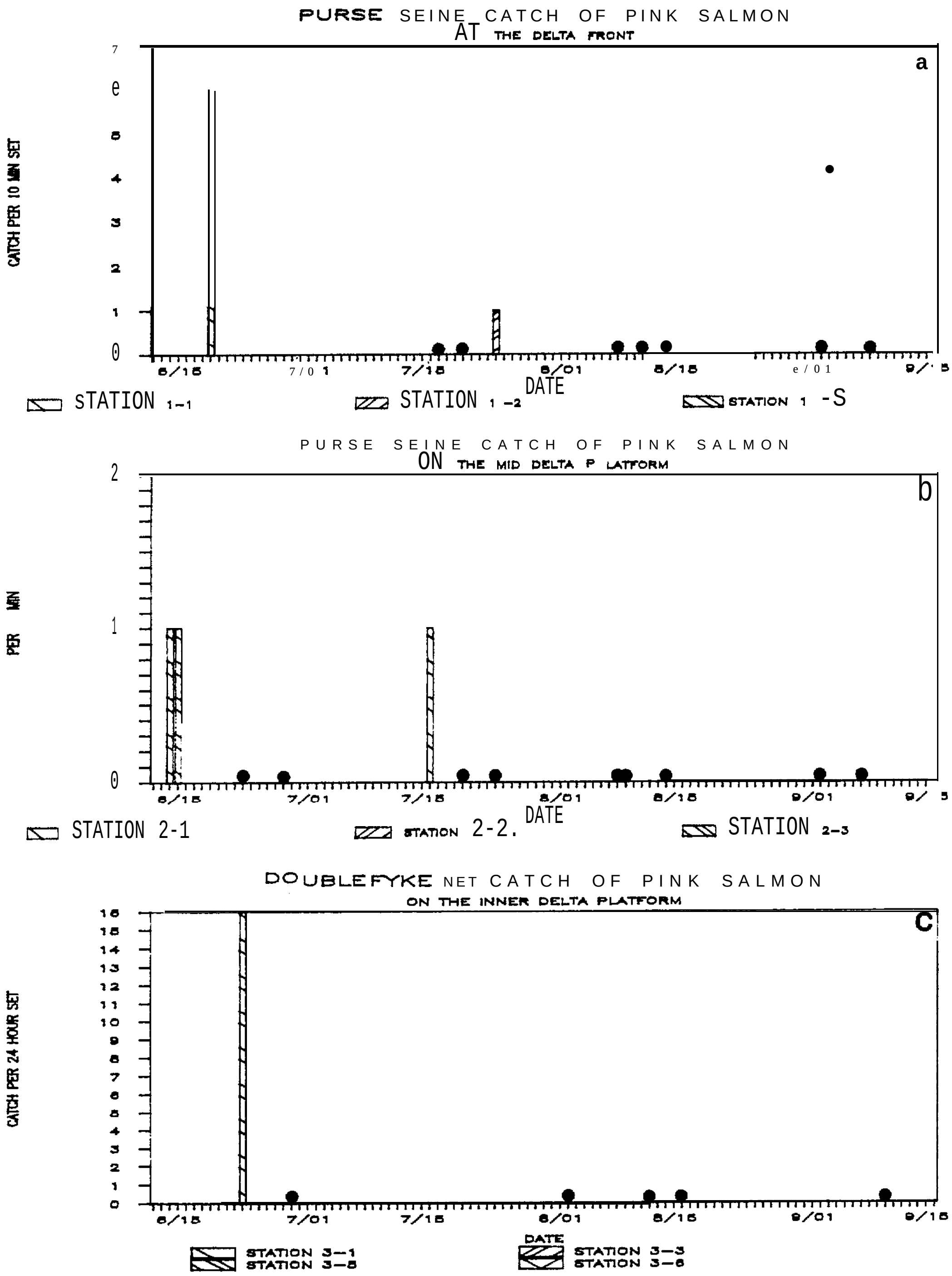
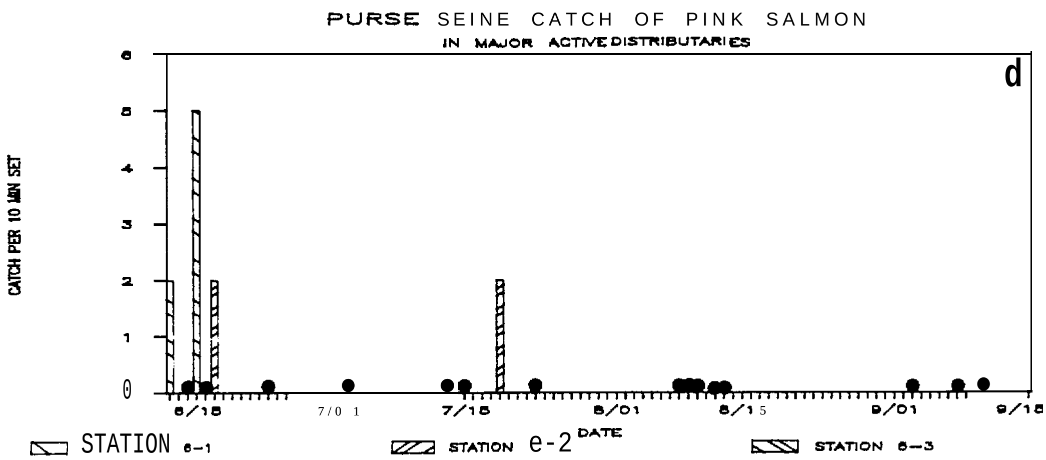


Figure 4-5. Catch Per Unit Effort of Pink Salmon in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(●) = Effort but no catch



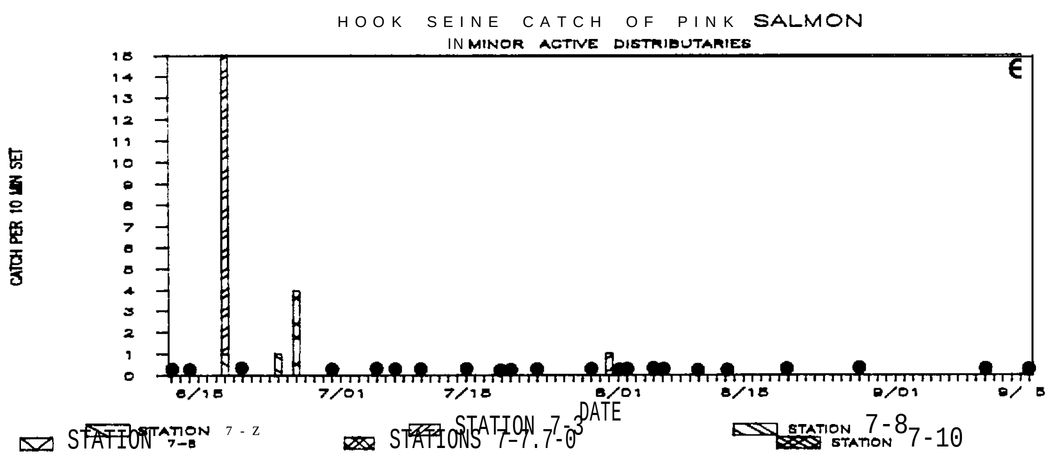


Figure 4-5. Catch Per Unit Effort of Pink Salmon in (d) Major Active Distributaries and (e) Minor Active Distributaries.

(●) = Effort but no catch

4.4.1.2 Size Composition

Chinook Salmon

Juvenile chinook salmon ranged in size from 60 to 119 mm fork length (Appendix C, Table 1). Smaller individuals (i.e., 70 to 109 mm) occurred most frequently during late June, while the individuals caught in late July tended to be larger (90 to 119 mm).

Chum Salmon

Juvenile chum salmon ranged in size from 30 to 109 mm fork length with the majority of fish falling into the 30 to 59mm size group (Appendix C, Table 2). Most larger fish ranged from 60 to 89 mm and were caught during June, July, and early August. One juvenile greater than 100 mm was caught during late June. Chum in the smaller size group had a modal length of 40-49 mm during later June and a modal length of 50-59 mm during late July.

Pink Salmon

Juvenile pink salmon ranged in size from 30-69 mm fork length with the majority of fish in the 30-39 mm size group (Appendix C, Table 3).

4.4.1.3 Residence Time

The results of the otolith analysis were based on the examination of 30 otoliths taken from juvenile chum salmon that were collected at 5 stations. In all fish examined, three distinct zones were identified by characteristic difference in otolith microstructure. An inner zone was located near the otolith primordia and was characterized by irregularly spaced dark bands which were intensely expressed. Following this zone was a relatively large middle region where otolith increments were difficult to discern. When increments were visible in this region, they were regular and very closely spaced. Surrounding the middle zone was an outer zone (edge zone) where otolith increment width showed a step-wise increase over the preceding increments. In this zone the dark organic components were distinct and increments were regularly spaced. The increment width and increment frequency in this zone provided the data which were analyzed for residence time.

The size of juvenile chum that were examined ranged from 38.2 to 58.0 mm in fork length and the number of otolith increments ranged from 13 to 29 (Table 4-11). The frequency of otolith increments among the entire sample was skewed by a high portion of fish with 14 edge zone increments. The average number of edge zone increments for each station ranged from 15.6 at station 6-2 to 23.6 at Station 2-1. Fish with 14 edge zone increments were the most frequent (five fish) (Figure 4-6). Nineteen and 22 increments were the next most common (three fish) and the remaining increment frequencies were seen in one and two fish each.

A comparison of the mean number of otolith increments among stations was performed with an analysis of variance test (ANOV) on data that were transformed to base 10 logarithms. Differences among stations were significant and two groups of stations were identified with a multiple range test (Table 4-12). The results indicate that chum at stations 7-8 and 2-1 had significantly more otolith increments than chum at station 6-2. Chum at stations 1-1, 6-3, and 2-2 were not significantly different from chum at either station 6-2 or stations 7-8 and 2-1.

4.4.2 Other Salmonid Fishes

4.4.2.1 Distribution, Timing, and Abundance

Sheefish

Sheefish were caught at 32 stations and were widely distributed among all major habitats. Sheefish were also fourth in abundance (7.1 percent) of all fish caught during the summer survey (Table 4-10).

TABLE 4-11
NUMBER OF OTOLITH INCREMENTS IN THE EDGE ZONE AND MEAN
WIDTH OF OTOLITH INCREMENTS FOR JUVENILE CHUM SALMON
CAUGHT DURING THE SUMMER 1985 SURVEY OF THE YUKON RIVER DELTA

Station	Date	Fork Length (mm)	Edge Zone Increments Number	Group Mean	Group 95% C.L.	Mean Increments Width (urn)
1-1	6/21 /85	46.0	25			2.11
		40.0	14			2.15
		38.5	14			2.15
		56.1	13			2.32
		44.6	20			1.89
				17.2	10.8-23.6	
2-1	6/30/85	51.8	21			3.95
		51.5	28			2.15
		43.8	18			2.93
		47.6	25			2.71
		58.0	26			3.19
				23.6	18.6-28.6	
2-2	6/25/86	52.5	23			3.28
		48.3	19			-
		38.2	16			1 .89
		45.2	19			2.78
		45.0	19			1.98
				19.2	16.1-22.3	
6-2	6/19/85	43.7	16			2.36
		43.7	17			1.77
		40.0	17			2.66
		40.8	14			2.15
		40.5	14			2.15
				15.6	13.7-17.5	
6-3	6/25/86	45.0	29			2.08
		43.9	14			2.69
		47.0	15			2.01
		48.4	20			2.26
		49.4	18			2.93
				19.2	11.8-26.6	
7-8	6/28/85	48.5	24			2.51
		51.8	22			2.74
		45.2	23			1.97
		45.0	22			2.74
		44.4	22			2.40
				22.6	21 .5-23.7	

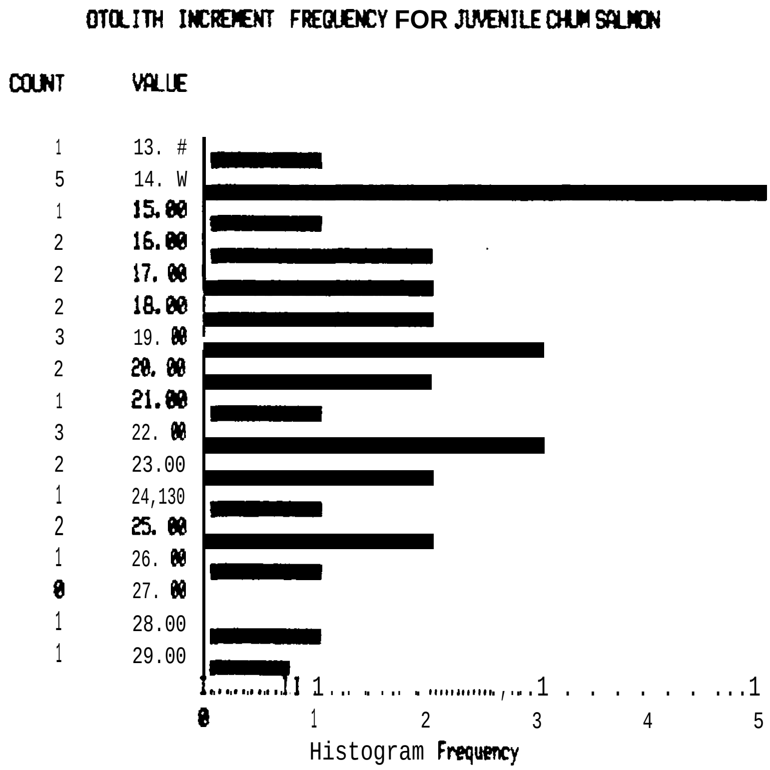


Figure 4-6. Otolith Increment Frequency for Juvenile Chum Salmon Collected During Summer 1985 from the Yukon River Delta.

TABLE 4-12

RESULTS OF ANALYSIS OF VARIANCE AND MULTIPLE-RANGE TESTS ON THE NUMBER OF EDGE ZONE INCREMENTS IN CHUM SALMON OTOLITHS

Source	P.F.	Analysis of Variance Sum of Squares	Mean Square	F Ratio	F Prob.
Between Groups	5	.1228	.0246	3.5138	.0159
Within Groups	24	.1678	.0070		
Total	29	.2906			

MULTIPLE-RANGE TEST

Group	Stations					
1	6-2	1-1	6-3	2-2		
2		1-1	6-3	2-2	7-8	2-1

The greatest number of sheefish were caught with fyke nets in mudflats and tidal sloughs. The single largest catch of 587 fish was recorded on July 24 at mudflat Station 4-4 (Appendix B, Table 2). Large numbers of sheefish were caught in the lake outlet channel, as well, where daily catches ranged up to 78 fish.

The abundance of sheefish was highly variable over the summer. Low numbers of sheefish were initially found during late June in tidal slough, minor active distributary, lake outlet channel, and major inactive distributary habitats (Figure 4-7). During early July, the abundance of sheefish increased dramatically in active distributary and lake outlet channel habitats (Figures 4-7f to 4-7j) as a result of the downstream movement of juvenile fish. Fish utilized the lake outlet channel primarily from July 3 to July 16. During this period fish tended to move into and out of the channel in about equal numbers (Figures 4-7h to 4-7j). After mid-July, sheefish began to occur in large numbers in tidal slough, mudfl at, and inner delta platform habitats (Figures 4-7c, d, and e). A high abundance of sheefish continued to be observed in these habitats through the summer sample period. Lower numbers of sheefish were also observed in the mid-delta platform and delta front during late July and early August. However, no sheefish were found in these habitats during late summer (Figures 4-7a and b).

Humpback and Broad Whitefish

Humpback and broad whitefish had similar distributions and were found in lake, inactive distributary, active distributary, and coastal habitats (Table 4-10). Humpback whitefish also occurred in the inner delta platform and were generally more abundant than broad whitefish in all habitats. Humpback and broad whitefish were caught in most habitats from late June through to the end of the summer sampling period (Figure 4-8 and 4-9). Fish catch was consistently low in active distributary habitats with no indication of any significant peaks in abundance. On the other hand, catch in the tidal slough, mudflat, and inner delta platform habitats were highly variable between species and

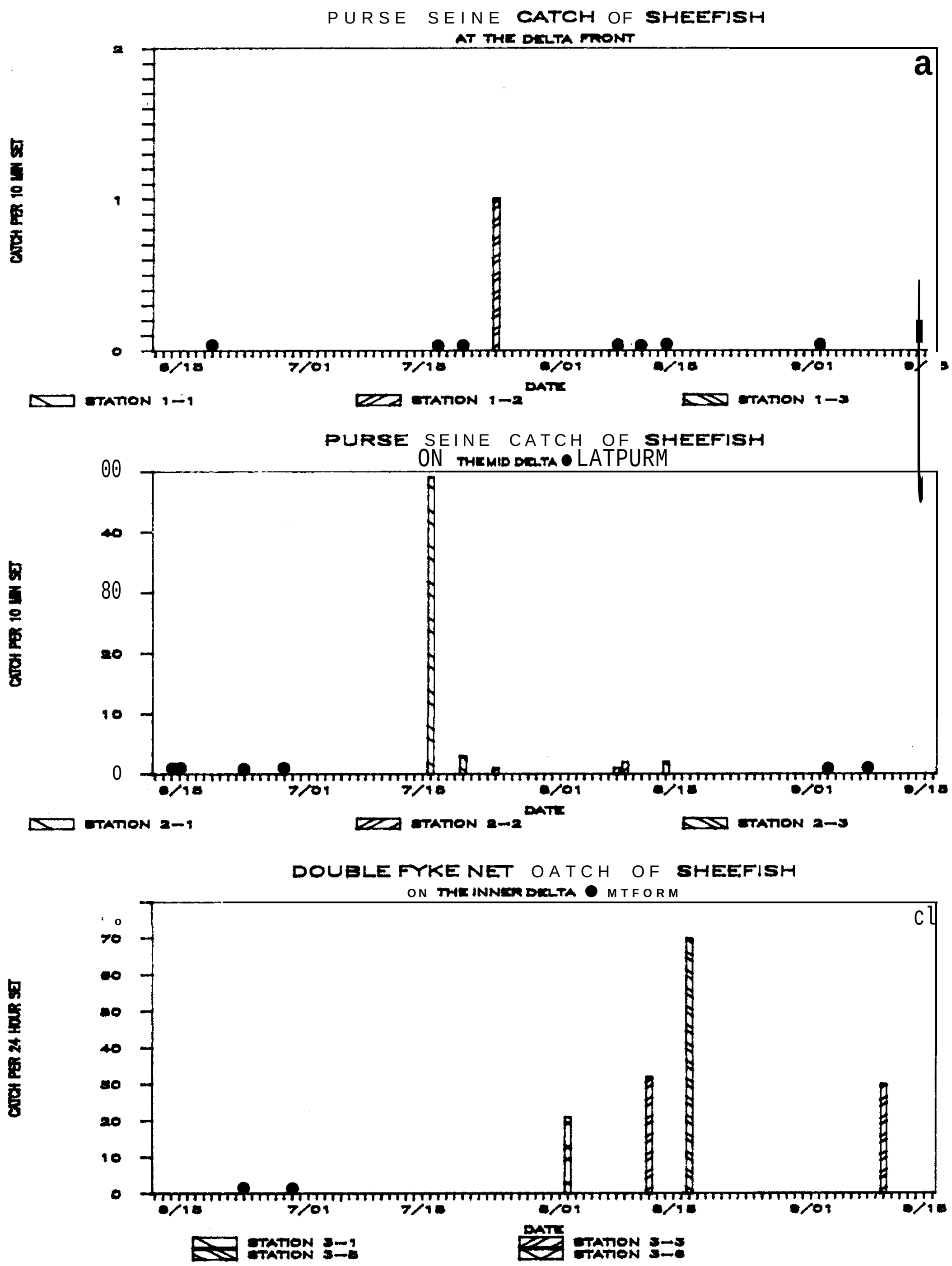


Figure 4-7. Catch Per Unit Effort of Sheefish in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(.) = Effort but no catch.

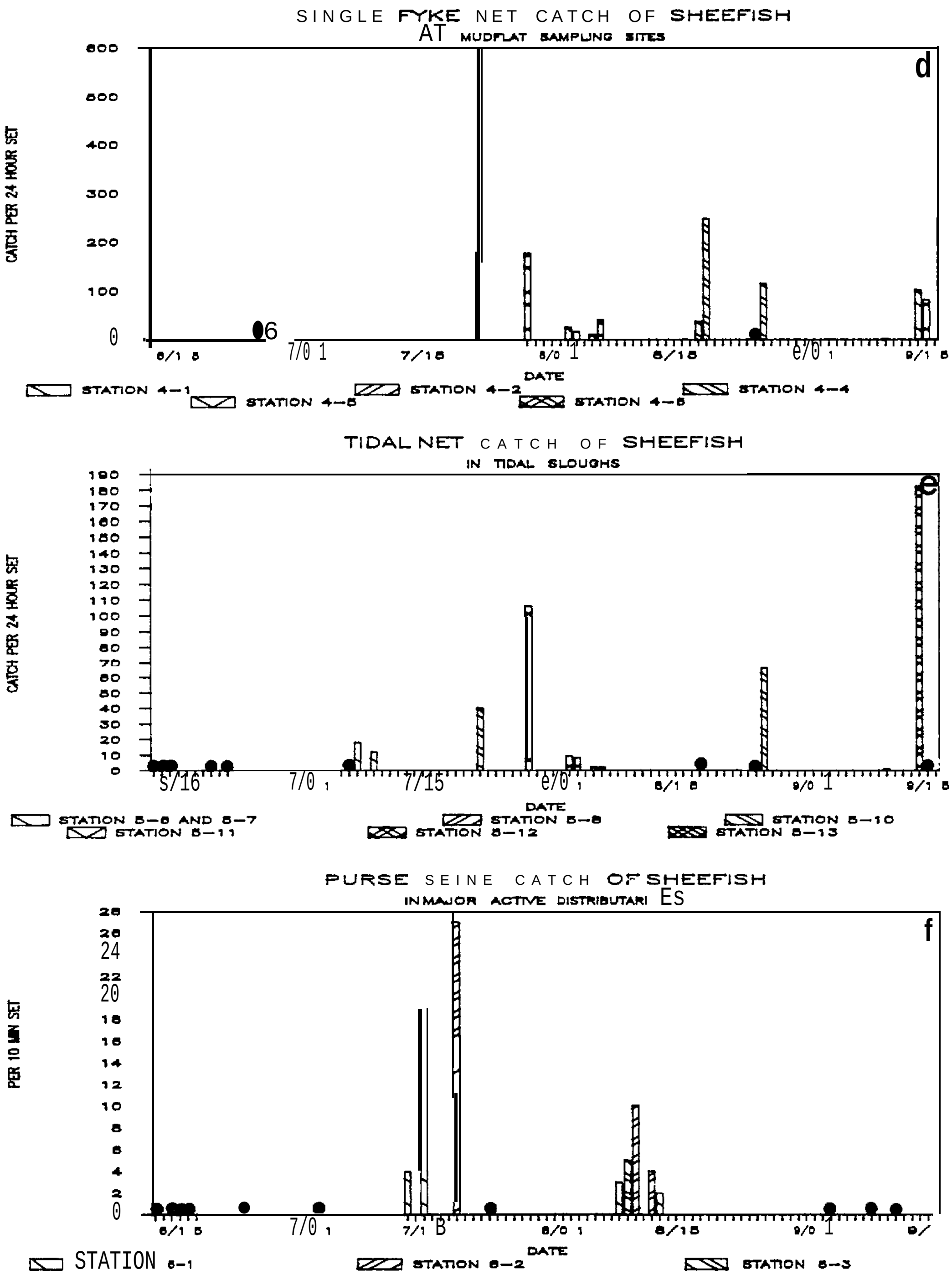


Figure 4-7. Catch Per Unit Effort of Sheefish in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Major Active Distributaries.

(●) = Effort but no catch.

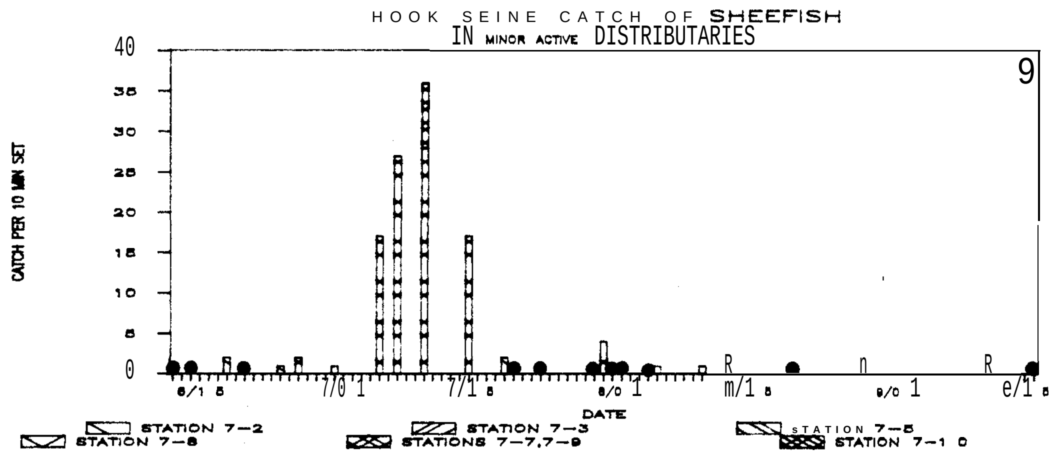


Figure 4-7. Catch Per Unit Effort of Sheefish in (g) Minor Active Distributaries.

(●) = Effort but no catch.

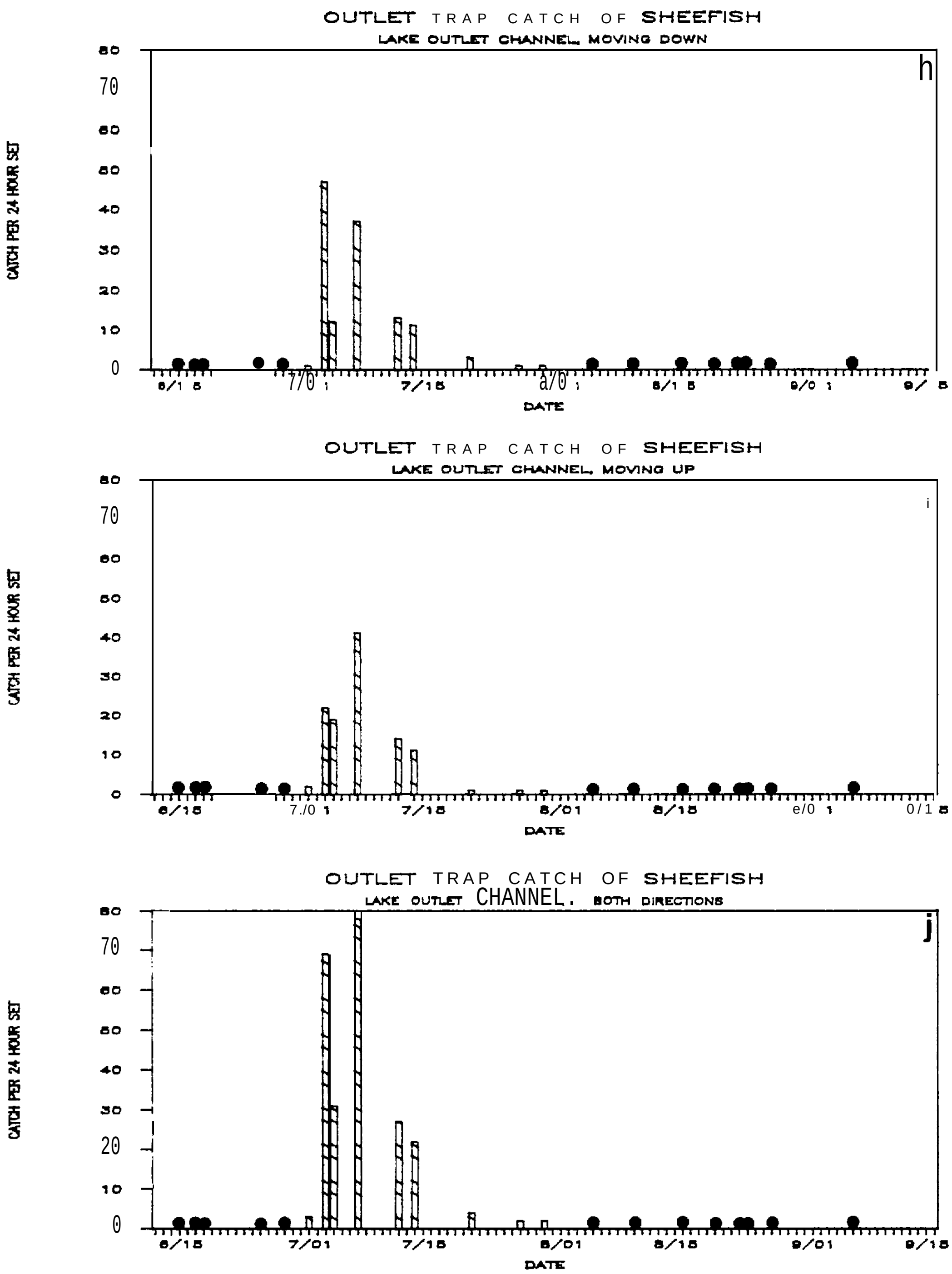


Figure 4-7. Catch Per Unit Effort of Sheefish in h) Lake Outlet Channel, Moving Down, (i) Lake Outlet Channel, Moving Up, and (j) Lake Outlet Channel, Both Directions.

(●) = Effort but no catch.

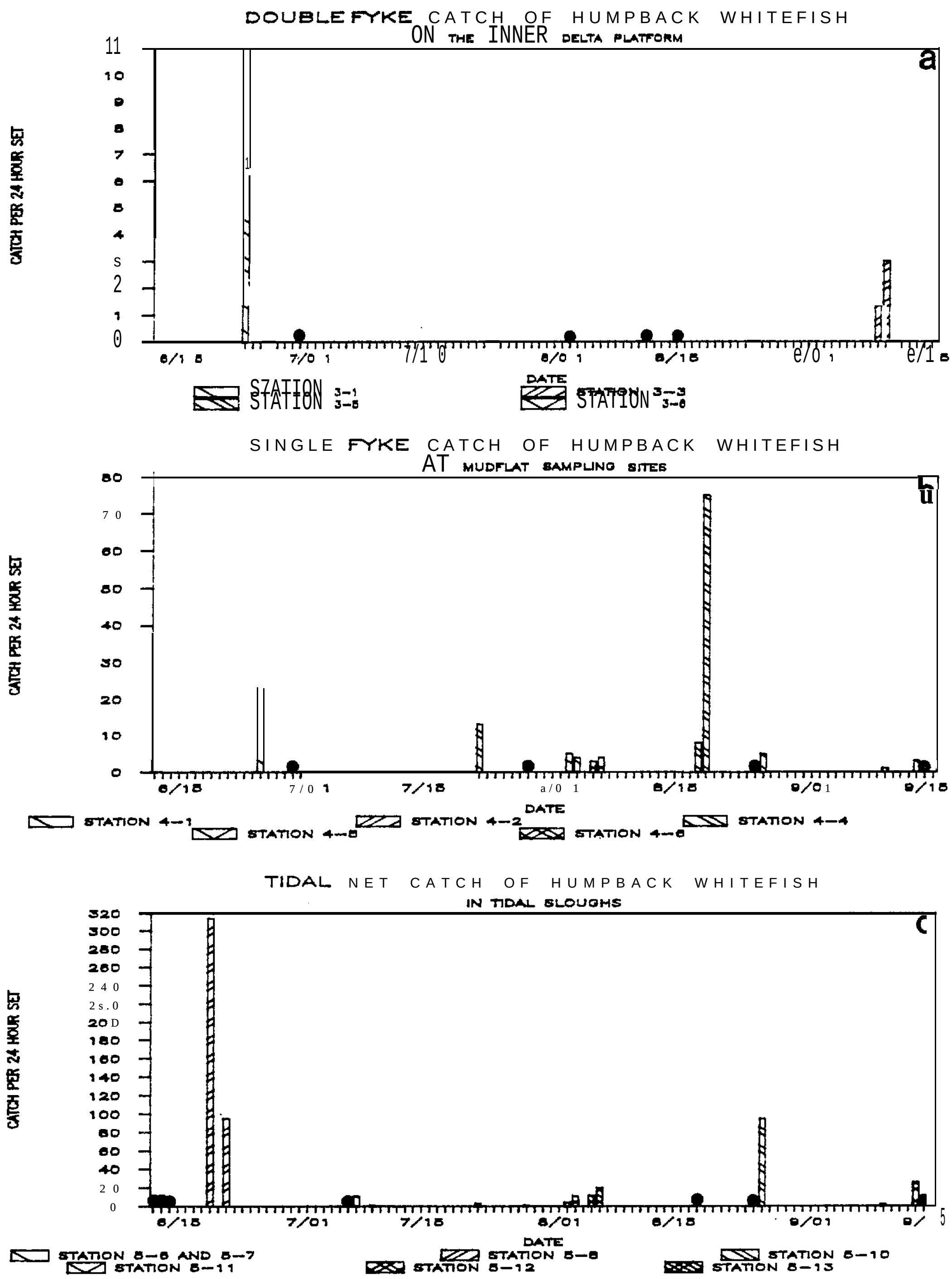


Figure 4-8. Catch Per Unit Effort of Humpback Whitefish in (a) Inner Delta Platform, (b) Mudflat Sampling Sites, and (c) Tidal Sloughs.

(●) = Effort but no catch.

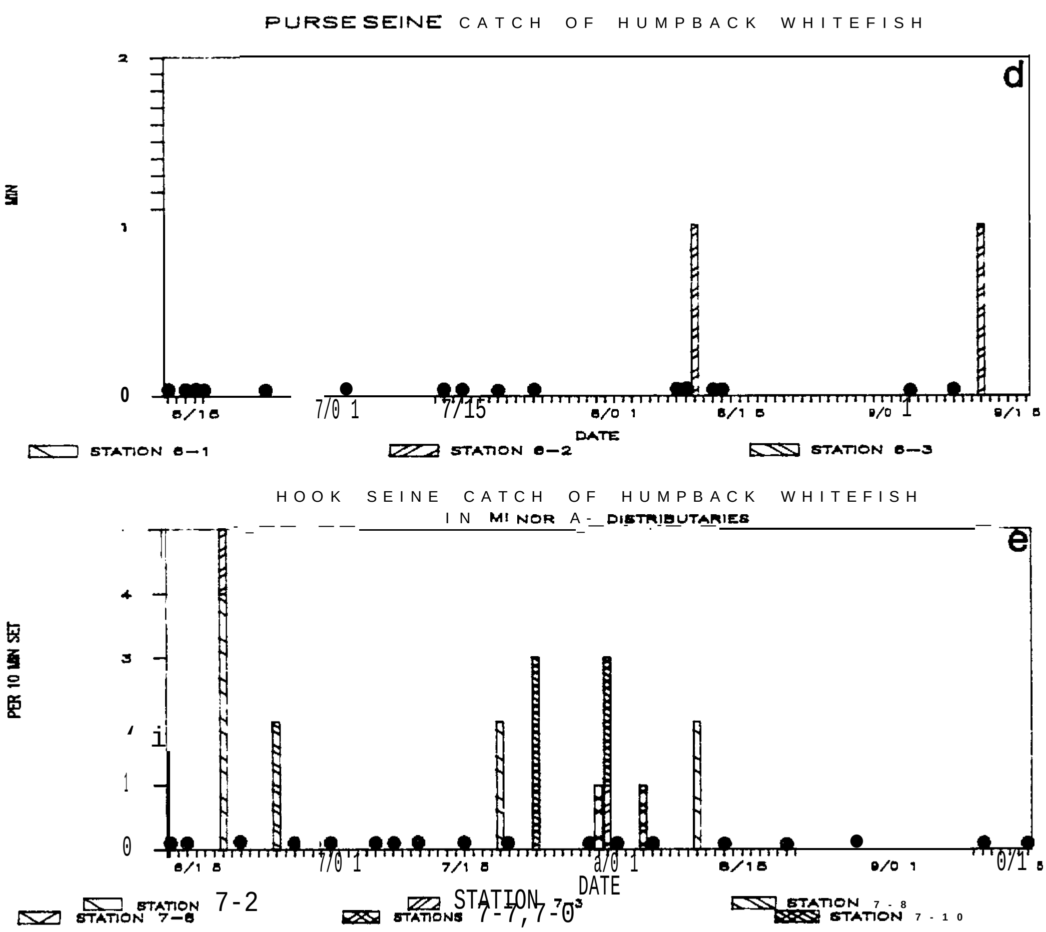


Figure 4-8. Catch Per Unit Effort of Humpback Whitefish in (d) Major Active Distributaries and (e) Minor Active Distributaries.

(●) = Effort but no catch

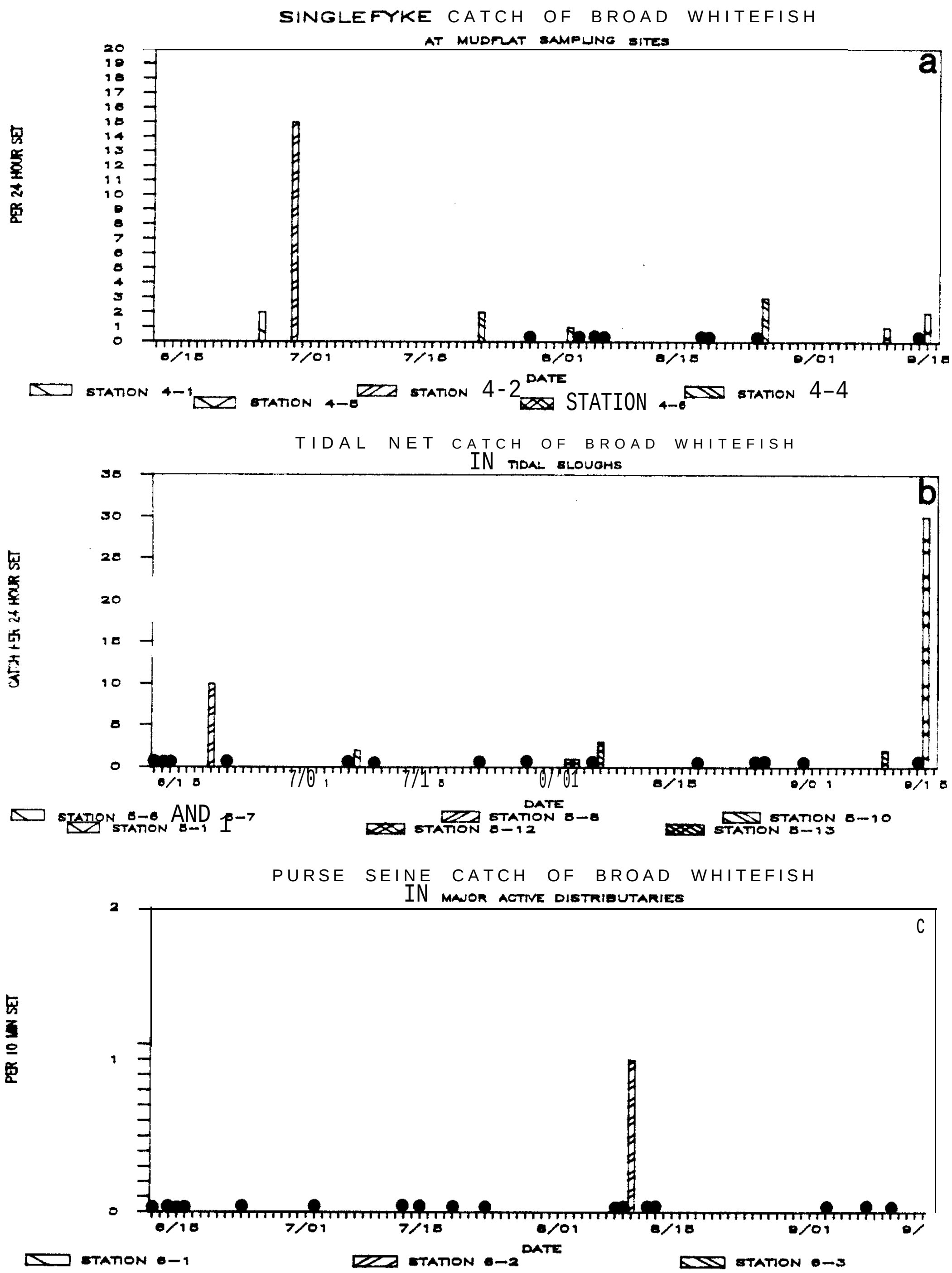


Figure 4-9. Catch Per Unit Effort of Broad Whitefish in (a) Mudflat Sampling Sites, (b) Tidal Sloughs, and (c) Major Active Distributaries.

(●) = Effort but no catch.

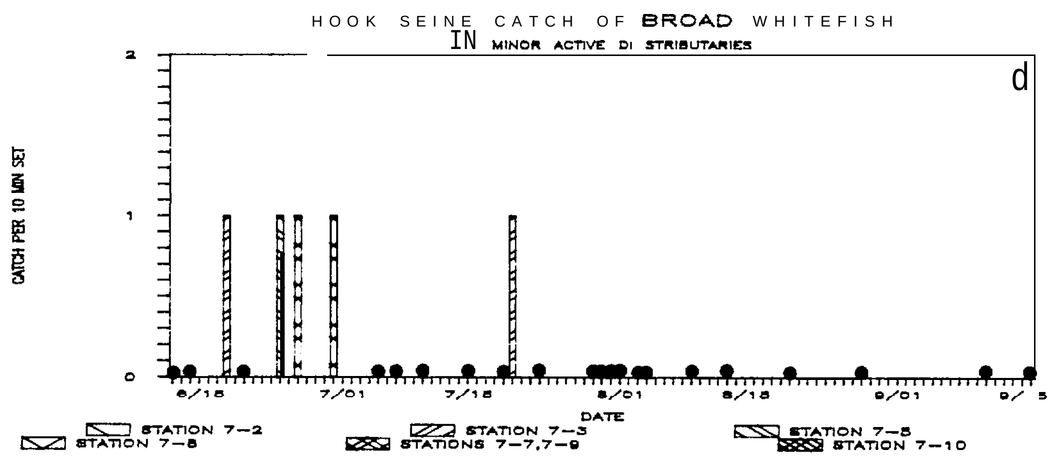


Figure 4-9. Catch Per Unit Effort of Broad Whitefish in (d) Minor Active Distributaries.

(.) = Effort but no catch.

over time. Humpback whitefish were more abundant during late June in the delta platform and tidal slough than during the late summer (August and September) periods (Figures 4-8a and c). An opposite trend in abundance was observed in the mudflat habitat because a large number of humpback whitefish were caught on August 21 (Figure 4-8b). Fish were less abundant during early summer and more abundant late in the summer. The abundance of broad whitefish similarly was variable in tidal slough and mudflat habitats during the summer (Figure 4-9a and b).

Unidentified Whitefish

Unidentified whitefish were by far the most abundant group of fish (accounted for 33 percent of total catch) caught during the summer survey (Table 4-10). Unidentified whitefish, which were primarily composed of juvenile humpback and broad whitefish, showed a more distinct pattern in distribution and timing than adult whitefish (Figure 4-10). Large numbers of juvenile fish occurred almost simultaneously in all habitats after mid-July. Active distributaries showed a peak in abundance between the first and fifteenth of August and a rapid decline in abundance to almost zero during the remaining season (Figure 4-10d and e). The lake outlet channel showed a similar short-term utilization which occurred between July 23 and August 7 (Figures 4-10g h, and i). Fish movements into the tidal slough and mudflat habitats were extensive during late July and early August. Daily catches of whitefish ranged into the thousands (Figure 4-10C and d), but catches in these habitats declined to a low-level by mid-August and remained low throughout the rest of the summer. Fish occurred in the delta platform during August and were present through the end of sampling.

Bering Cisco and Least Cisco

Bering cisco and least cisco were moderately abundant and accounted for two percent of the total catch (Table 4-10). The distribution of the two species was different and least cisco was much more abundant than Bering cisco. Least cisco were widely distributed and found in all

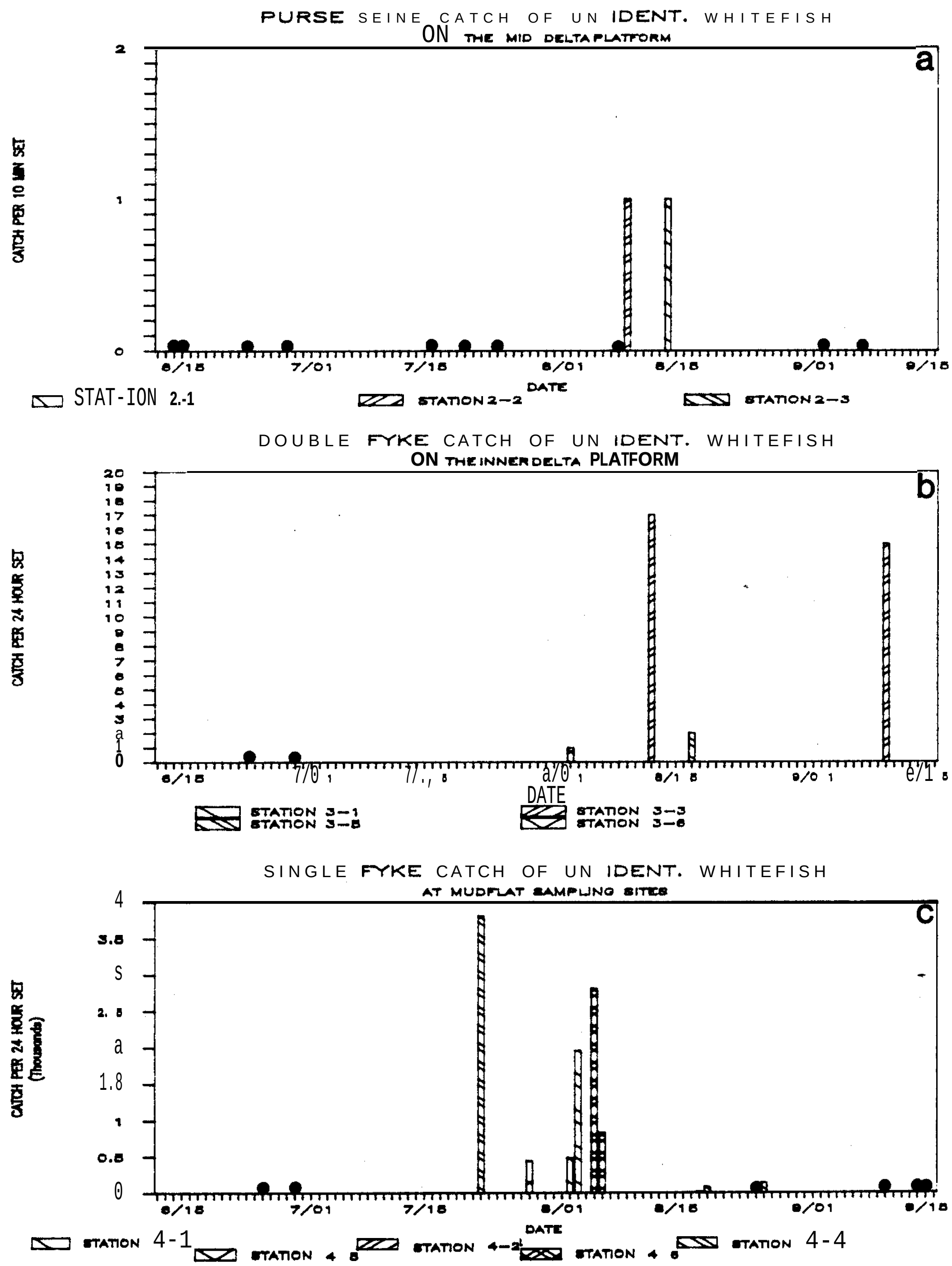


Figure 4-10. Catch Per Unit Effort of Unidentified Whitefish in (a) Mid Delta Platform, (b) Inner Delta Platform, and (c) Mudflat Sampling Sites.

(●) = Effort but no catch.

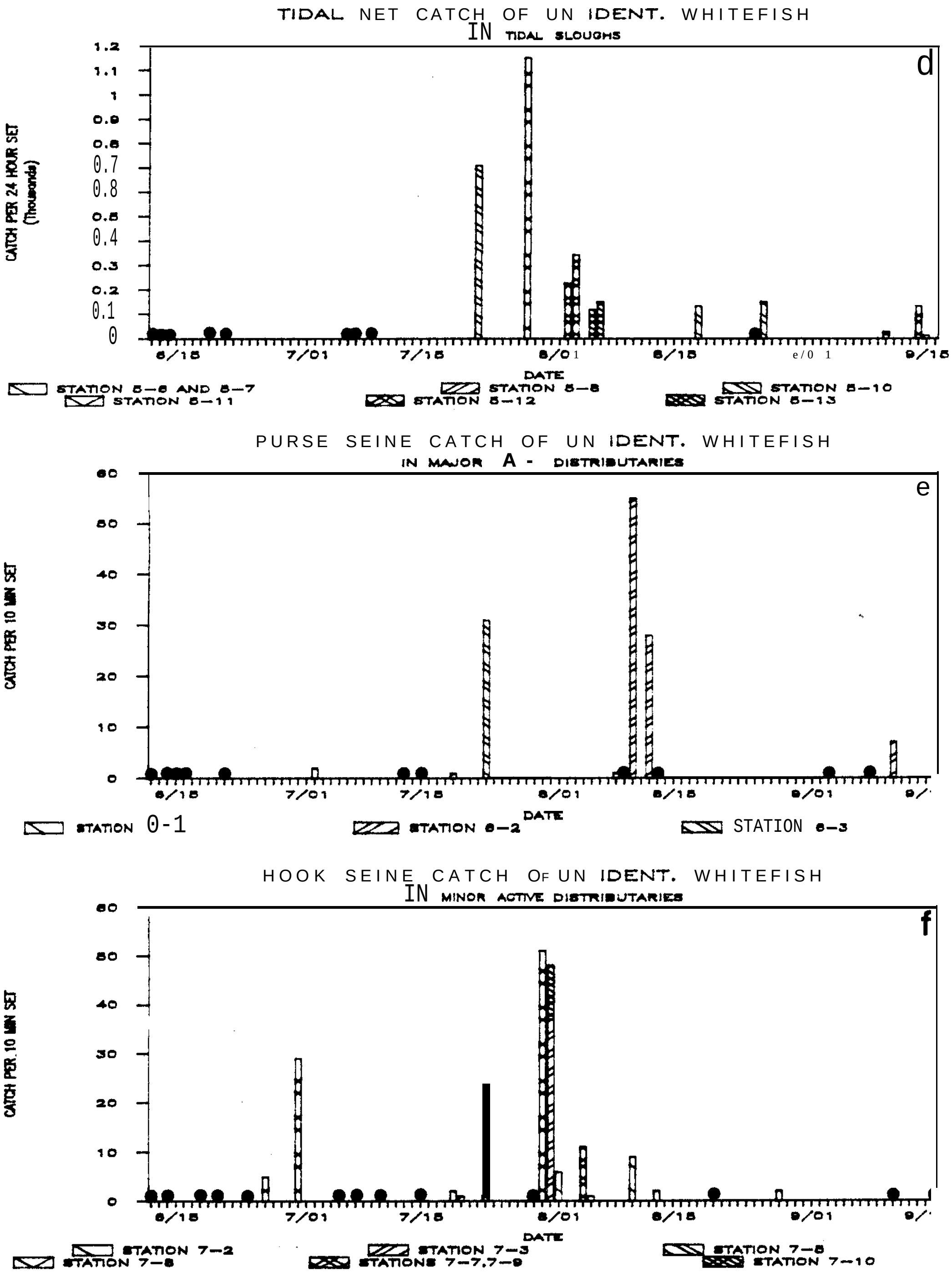


Figure 4-10. Catch Per Unit Effort of Unidentified Whitefish in (d) Tidal Sloughs, (e) Major Active Dist-ributaries, and (f) Minor Active Distributaries.

(●) = Effort but no catch.

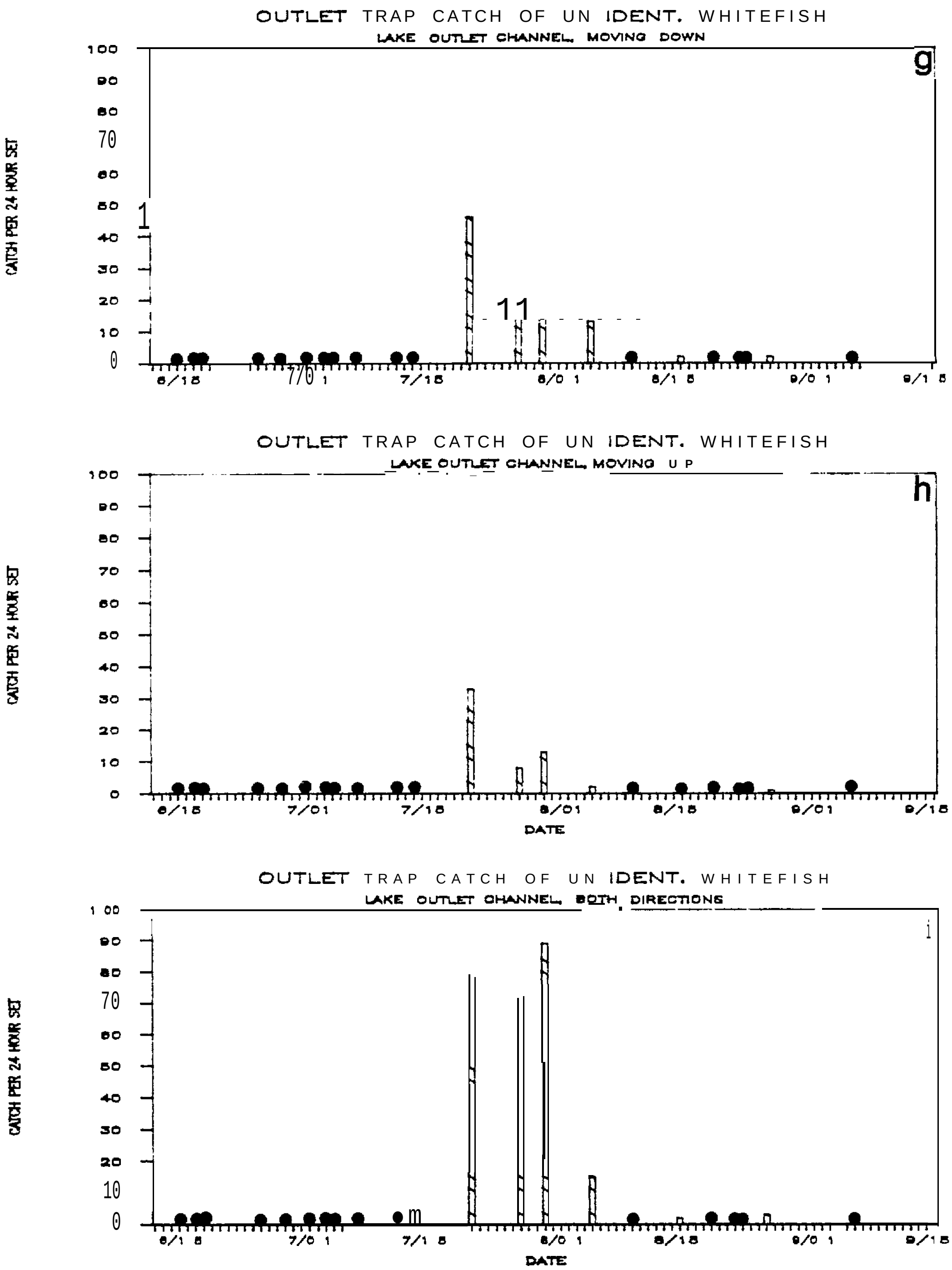


Figure 4-10. Catch Per Unit Effort of Unidentified Whitefish in (g) Lake Outlet Channel , Moving Down, (h) Lake Outlet Channel , Moving Up, and (i) Lake Outlet Channel , Both Directions.

(●) = Effort but no catch.

major habitats except the delta front. Bering cisco had a more restricted distribution which only included inner delta platform, mudflat, tidal slough, and minor active distributary habitats.

The timing of habitat utilization was different between both species of cisco. Bering cisco were virtually absent from all catches until late July (Figure 4-11). From late July to the end of the sampling period, Bering cisco were relatively abundant in tidal slough and mudflat habitats (Figure 4-11b and c) and only occasionally present in the inner delta platform. On the other hand, least cisco were relatively abundant in the mudflat, tidal slough, and minor active distributary habitats before the end of June (Figures 4-12c, d, and f). Catches on the delta platform were low, but cisco were present in this habitat throughout the summer. Fish were most abundant in the mudflat and tidal slough habitats and were observed in these habitats all summer.

Unidentified Cisco

Unidentified cisco were the third most abundant group of fish (6.9 percent of total catch) caught during the sinner survey (Table 4-lo). Unidentified cisco were similar to the unidentified whitefish in that they occurred simultaneously in all habitats on or about July 2 5th. Relatively high numbers of cisco occurred in the delta front and delta platform at this time and remained in these habitats throughout the summer (Figure 4-13a, b, and c). Very large numbers of fish were caught in tidal sloughs and mudflats during the same period (Figures 4-13d and e). Unidentified cisco continued to be present in active distributaries during August and September, unlike the declining trend which was observed for unidentified whitefish. Cisco moved into and rapidly out of the lake outlet channel similar to the movements patterns observed for sheefish and unidentified whitefish (Figures 4-13h, i, and j).

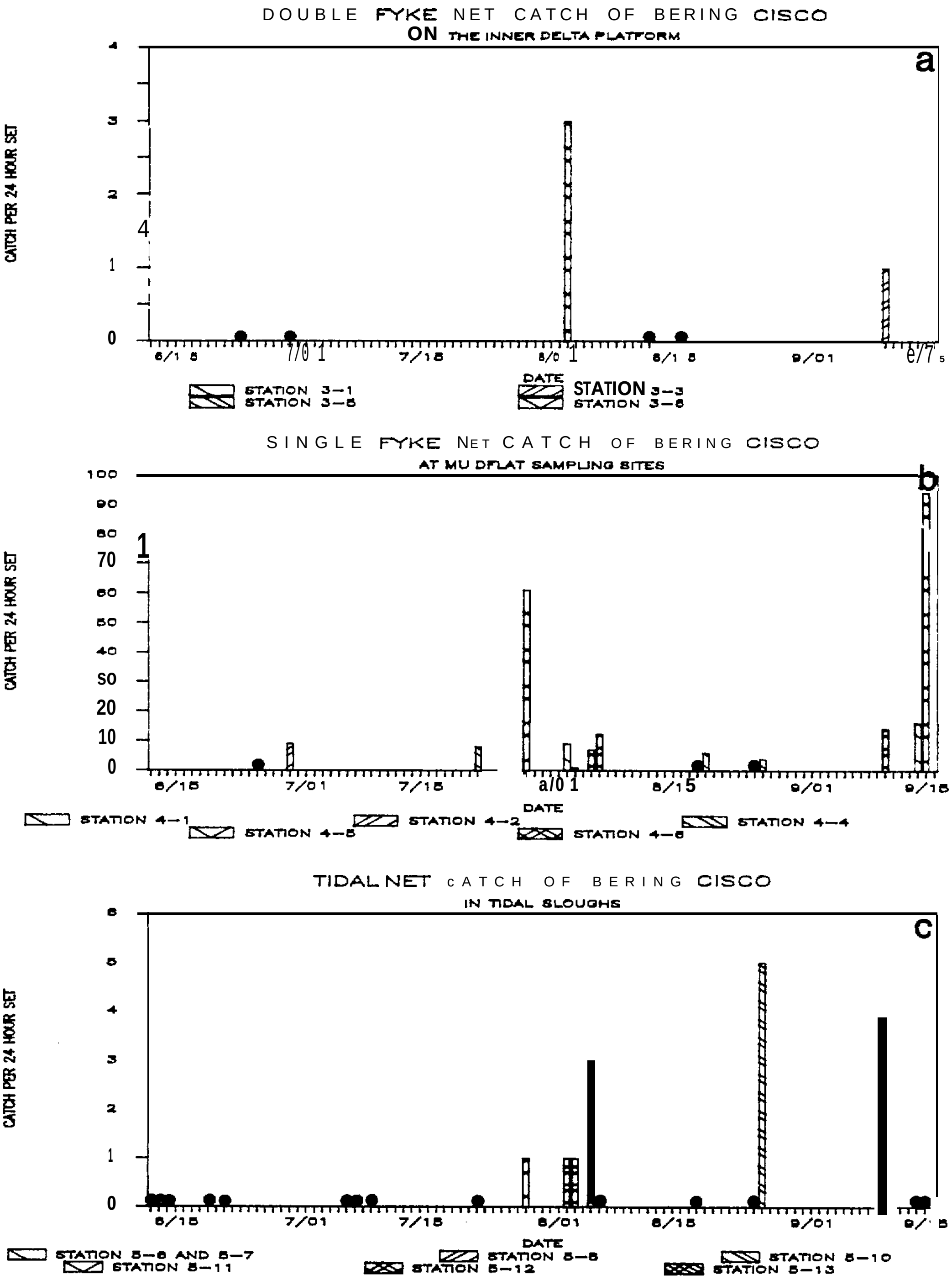


Figure 4-11. Catch Per Unit Effort of Bering Cisco in (a) Inner Delta Platform, (b) Mudflat Sampling Sites, and (c) Tidal Sloughs.

(●) = Effort but no catch.

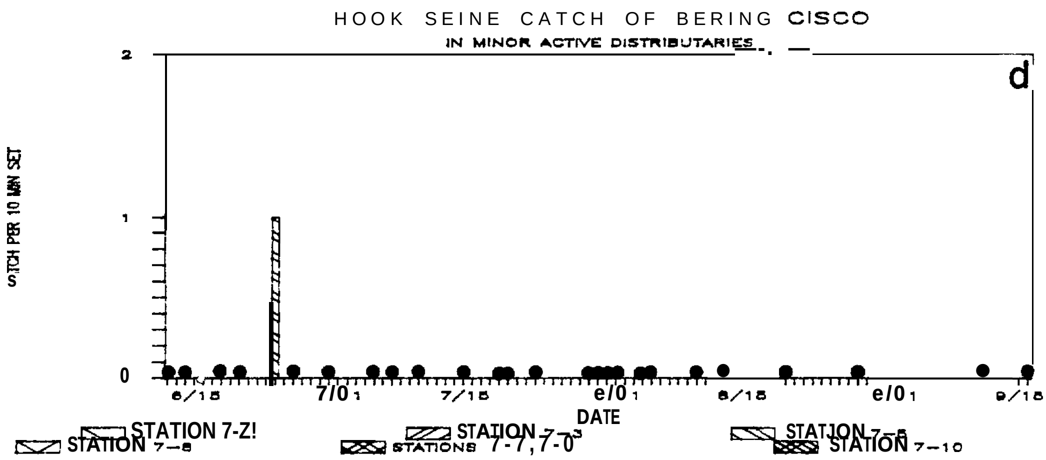


Figure 4-11. Catch Per Unit Effort of Bering Cisco in (d) Minor Active Distributaries.

(.) = Effort but no catch.

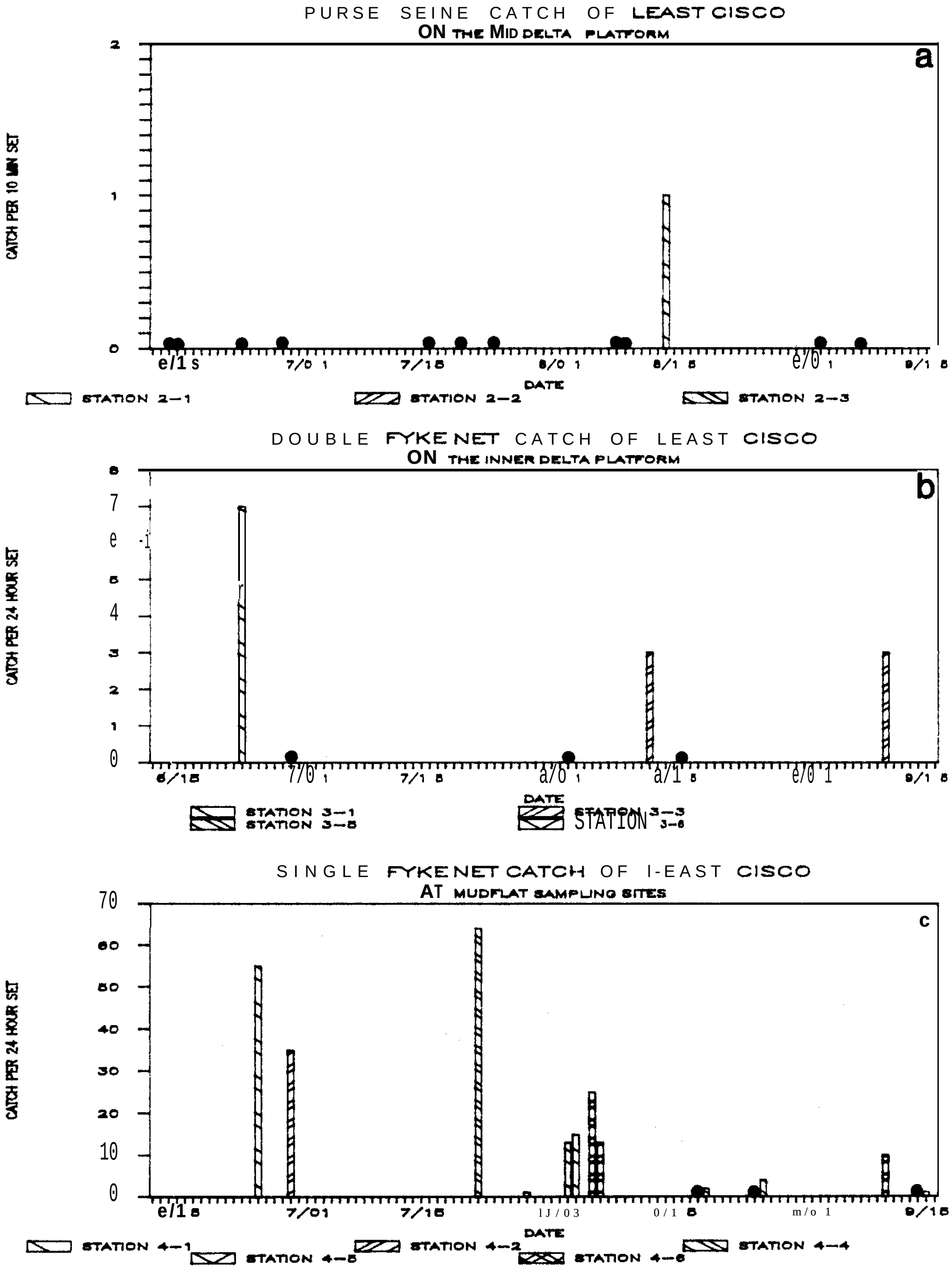


Figure 4-12. Catch Per Unit Effort of Least Cisco in (a) Mid Delta Platform, (b) Inner Delta Platform, and (c) Mudflat Sampling Sites.

(.) = Effort but no catch.

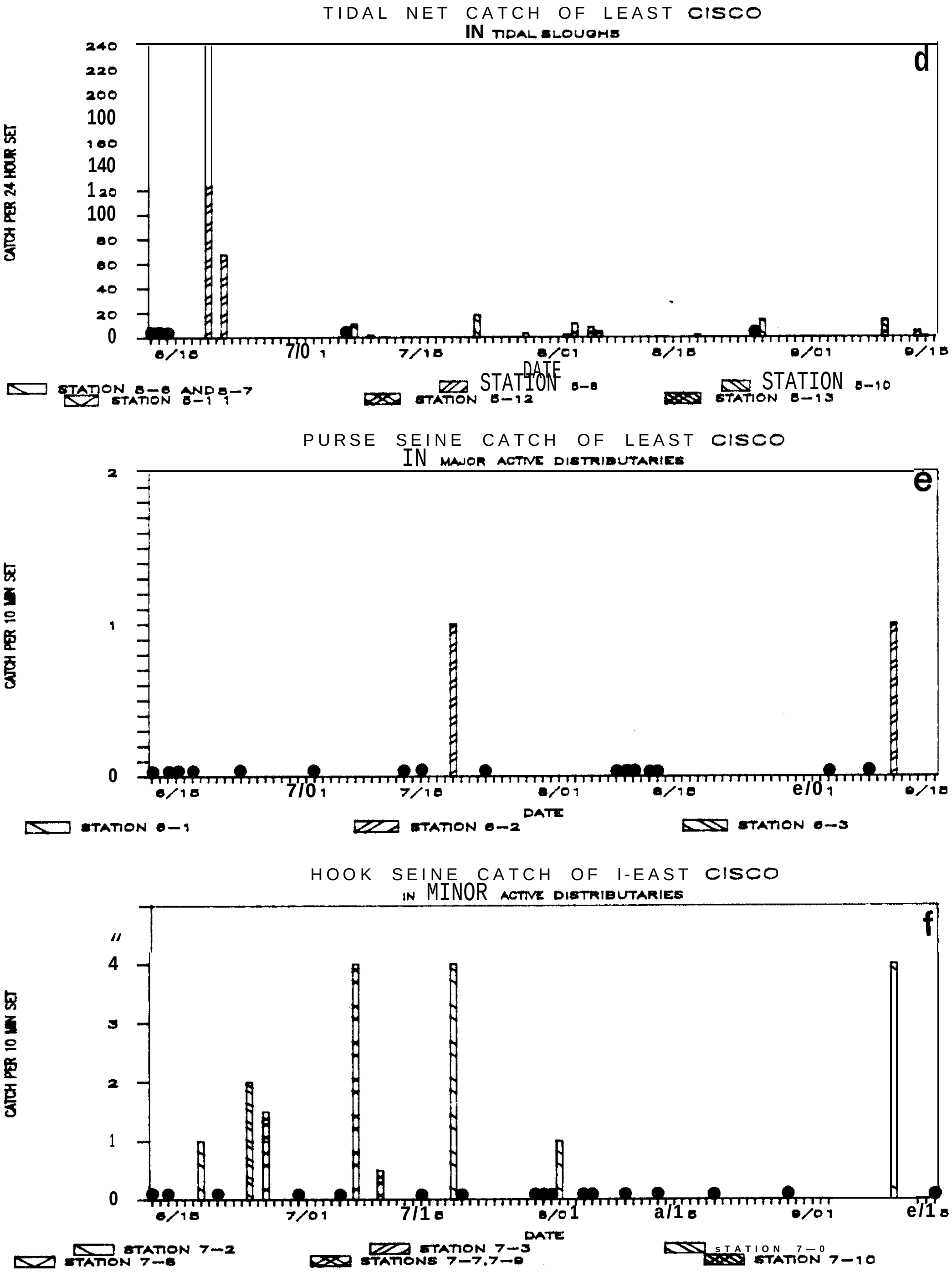


Figure 4-12. Catch Per Unit Effort of Least Cisco in (d) Tidal Sloughs, (e) Major Active Distributaries, and (f) Minor Active Distributaries.

(●) = Effort but no catch.

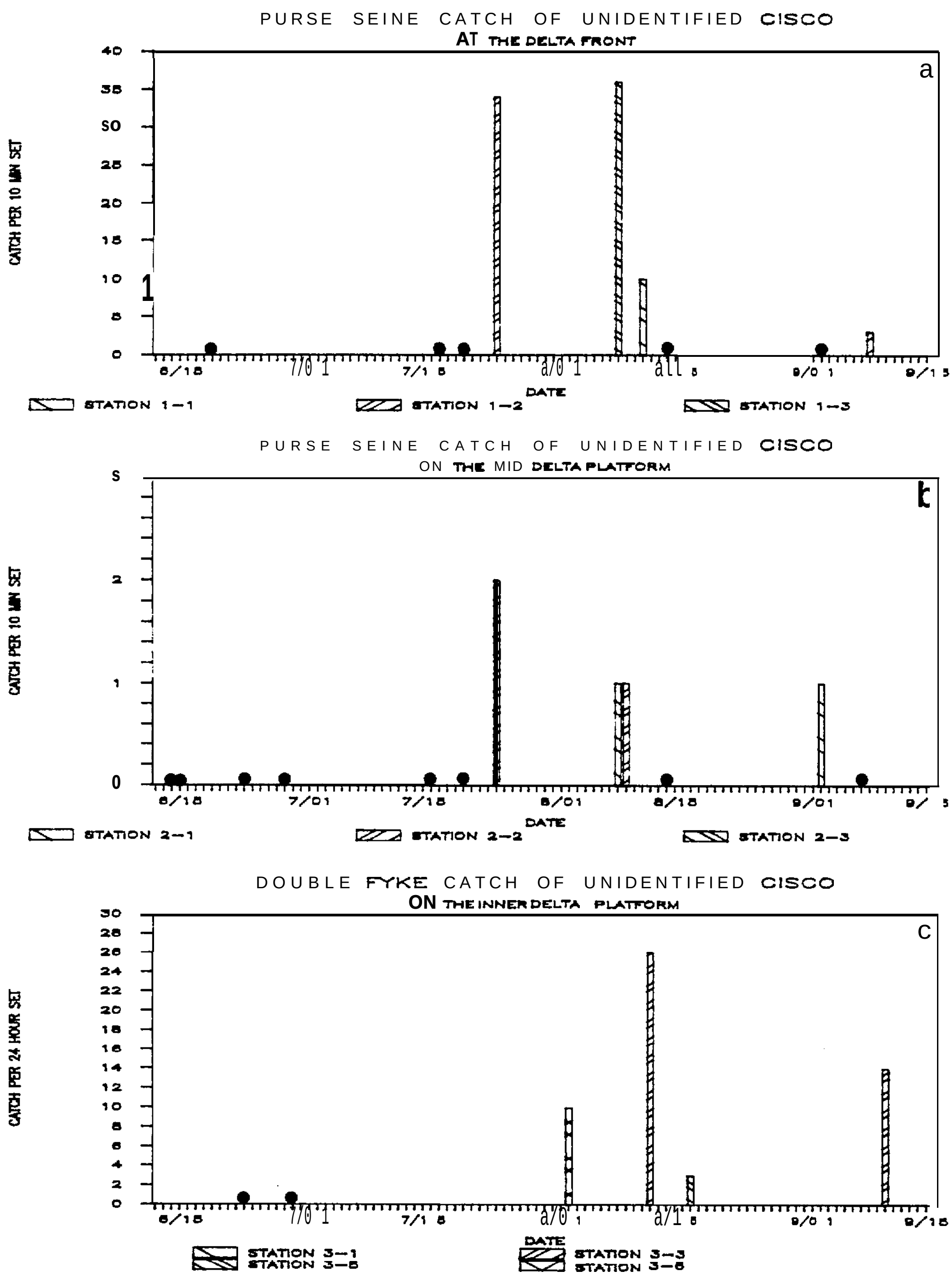


Figure 4-13. Catch Per Unit Effort of Unidentified Cisco in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(.) = Effort but no catch.

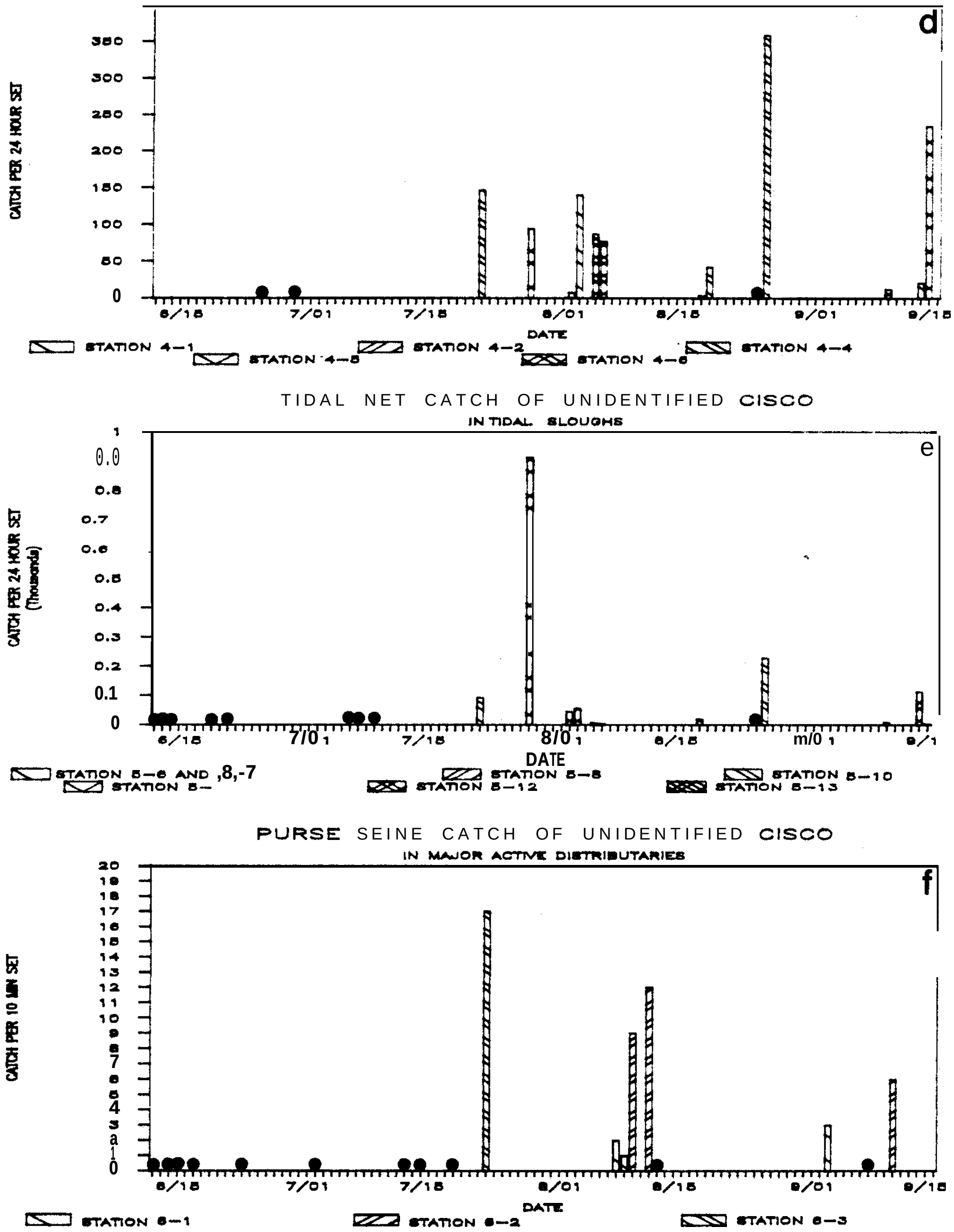


Figure 4-13. Catch Per Unit Effort of Unidentified Cisco in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Major Active Distributaries.

(●) = Effort but no catch.

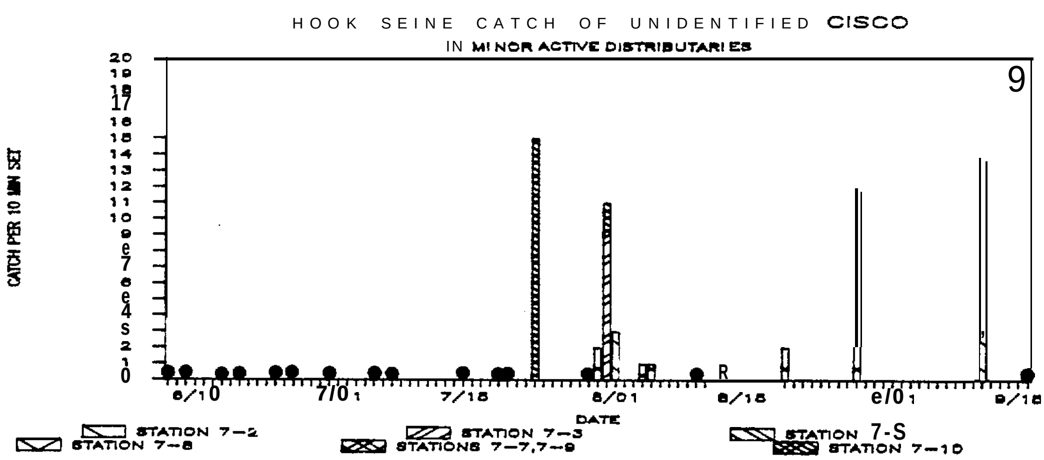


Figure 4-13. Catch Per Unit. Effort of Unidentified Cisco in (g) Minor Active Distributaries.

(.) = Effort but no catch.

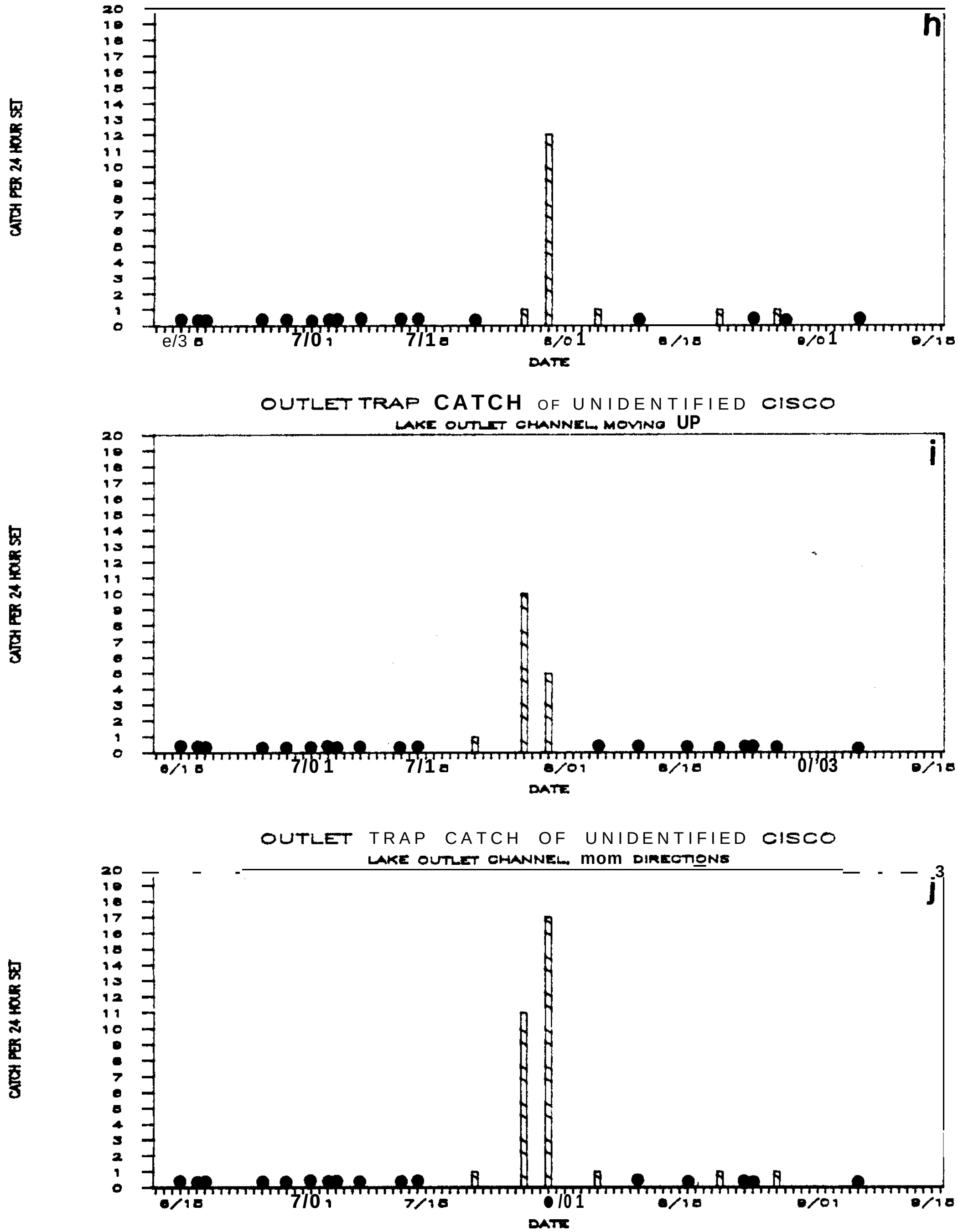


Figure 4-13. Catch Per Unit Effort of Unidentified Cisco in (h) Lake Outlet Channel, Moving Down, (i) Lake Outlet Channel, Moving Up, and (j) Lake Outlet Channel, Both Directions.

(●) = Effort but no catch.

4.4.2.2 Size Composition

Sheefish

Sheefish ranged in size from 10-729 mm in fork length (Appendix C, Table 4). The catch was composed of juvenile and adult size groups of which the young-of-the-year fish were dominant. Juveniles ranged from 30-70 mm in early July and grew rapidly to a size range of 100-150 mm by early September. Catch during late June was almost entirely composed of adult sheefish, whereas, catches during the remainder of the summer were dominated by juvenile fish. Juvenile fish were caught in all habitats, but the large adult fish were found predominantly in mudfl at, tidal slough, minor active distributary, and major inactive distributary habits.

Humpback Whitefish

Humpback whitefish ranged in size from 10 to 469 mm in fork length (Appendix C, Table 5). A minimum of five size groups can be identified from the length frequency distribution of which the yearling fish were dominant in abundance. Yearling fish ranged from 70 to 119 mm. Size group ranges for older fish were 120-159 mm, 160-229 mm, 230-299 mm, and greater than 300 mm. Yearling fish were most abundant in tidal slough and mudflat habitats throughout the summer. Larger fish tended to be present in all habitats at all times except in the lake outlet channel where they were only found in late June.

Broad Whitefish

Broad whitefish ranged in size from 80 to 399 mm in fork length (Appendix C, Table 6). Data for length frequency distribution tables were limited. Therefore, the catch could only be broken into yearling fish (90-139 mm) and larger fish (less than 130 mm). Distribution of these size groups was similar to that identified for humpback whitefish.

Unidentified Whitefish

The unidentified whitefish ranged in size from 20 to 239mm in fork length (Appendix C, Table 7). These fish were comprised of three size groups. Juvenile fish ranged from30 to 99mm in early July and from 60 to 109 mm in early September. Yearling fish ranged from 100 to 149 mm and older fish were greater than 150 mm. Juvenile fish were found in delta platform, coastal, active distributary, and lake outlet habitats. With the exception of the delta platform, yearling fish were found in the same habitats as the juveniles.

Bering Cisco

Bering cisco ranged in size from 80 to 439mm in fork length (Appendix C, Table 8). Data for length frequency distribution were limited by the low catch of Bering cisco. Therefore, a description of the size composition is difficult and interpretations of the results are limited. Nevertheless, two size groups ranging from 130 to 179 mm and from 280 to 319 mmwere dominant in the catch. These larger fish were mostly caught in the mudflats and were present in the catch throughout the summer.

Least Cisco

Least cisco ranged in size from 30 to 299mm in fork length (Appendix C, Table 9). Fish in the size range 70-120 mmwere dominant and were most likely comprised of yearlings. Larger fish could not be partitioned into specific size groups. Yearlings were most frequently found in mudflats and tidal sloughs during all time periods. The larger least cisco were present in all habitats during late June-early July, but were restricted to mudflat and tidal slough habitats later in the summer.

Unidentified Cisco

Unidentified cisco ranged in size from 30 to 159 mm in fork length (Appendix C, Table 10) which indicates a predominance of juvenile size fish. Juvenile cisco grew from a modal size of 50-59 mm in late July to a modal size of 80-89 mm in early September. Juvenile cisco occurred in all habitats after mid-July, whereas, larger cisco were mostly found in tidal sloughs.

4.4.3 Non-salmonid Fishes

4.4.3.1 Distribution, Timing, and Abundance

Boreal Smelt

A total of 3,650 boreal smelt were taken from offshore, coastal, and active distributary habitats (Table 4-10). The majority were caught in June (1,993 fish). Catches in July, August, and September were 324, 1104, and 229 respectively. All fish caught in September were from the delta front. The majority of the mid-delta fish were taken in July, and most of the fish from the inner delta and mud flats in August. The majority of the coastal sloughs and major and minor active distributary fish were caught in June.

Most of the boreal smelt were caught in 10 minute purse seine sets in the delta front and mid-delta (Figure 4-14). The 1 argest purse seine catch per unit effort (CPUE) occured in the delta front where a 10 minute set yielded 930 fish (Figure 4-14a). The CPUE of six other sets in the delta front produced 50 to 380 fish during the survey. Only one purse seine set in the mid-delta produced a large CPUE (243 fish), and very few boreal smelt were caught with this gear in the major active distributaries. The 24 hour double fyke net in the inner delta platform yielded a substantial CPUE of 49 and 273 fish on two occasions (Figure 4-11c). Small catches of boreal smelt were produced from 24

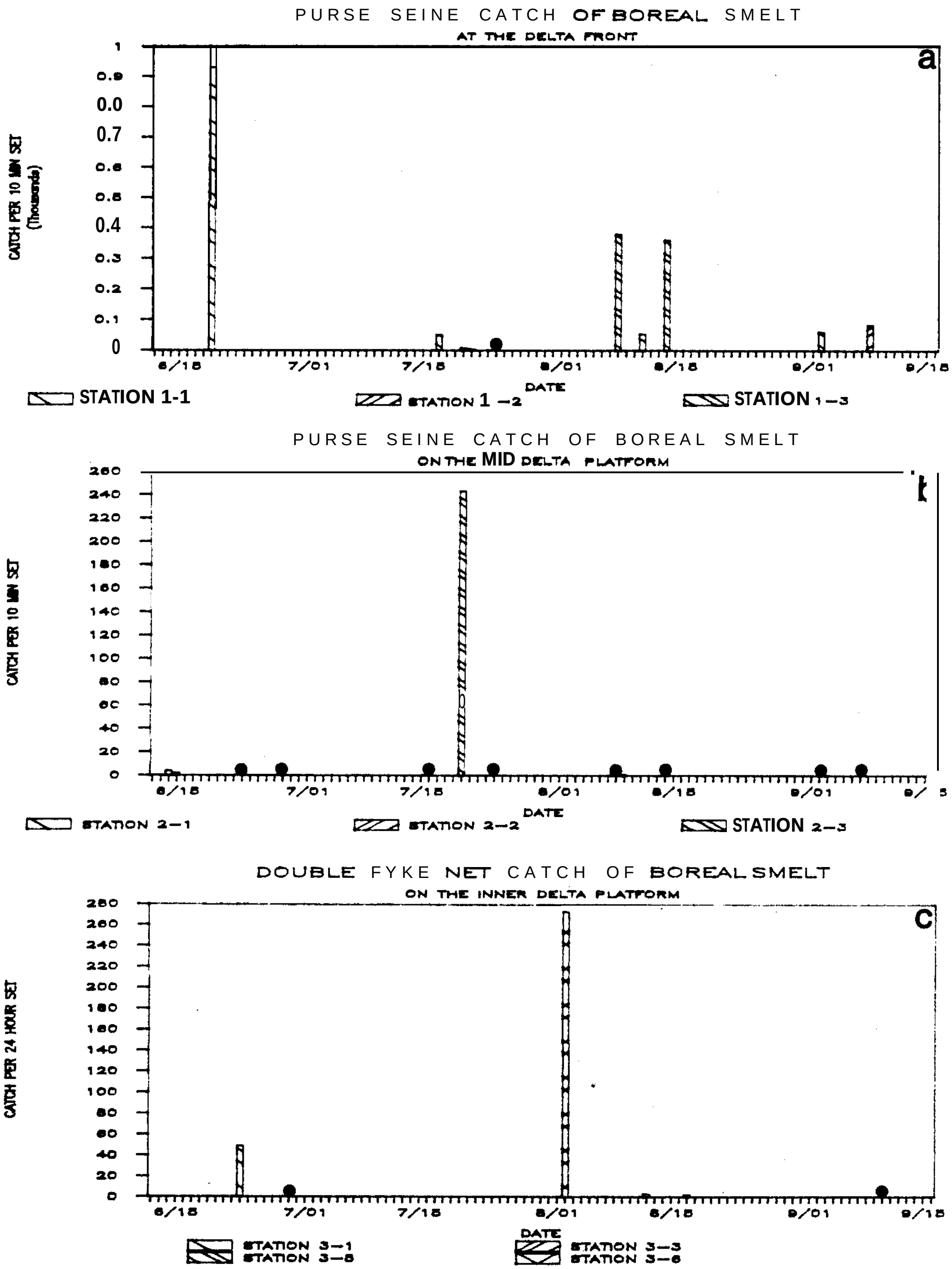


Figure 4-14. Catch Per Unit Effort of Boreal Smelt in (a) Delta Front, (b) M-id Delta Platform, and (c) Inner Delta Platform.

(●) = Effort but no catch.

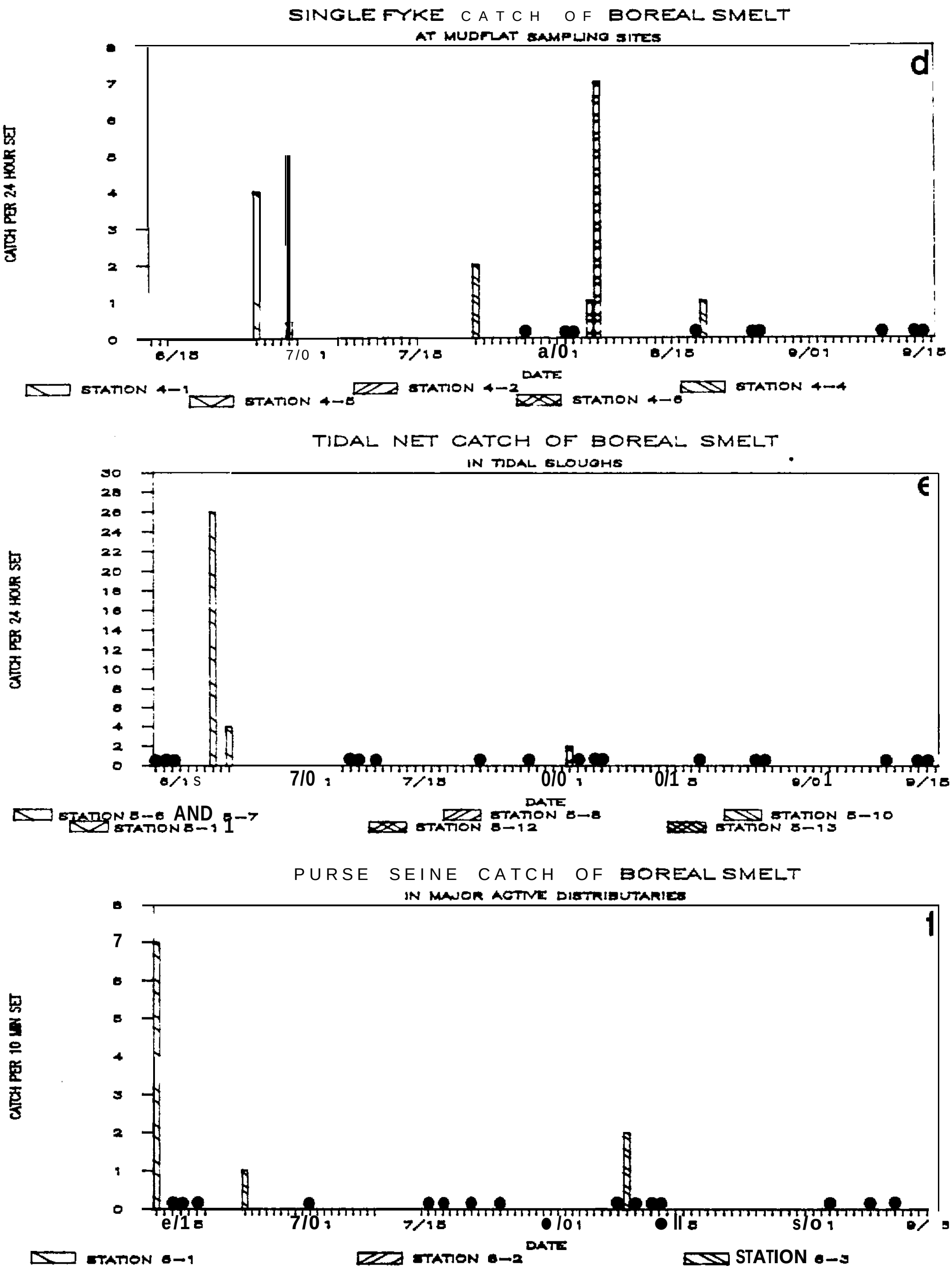


Figure 4-14. Catch Per Unit Effort of Boreal Smelt in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Major Active Distributaries.

(●) = Effort but no catch.

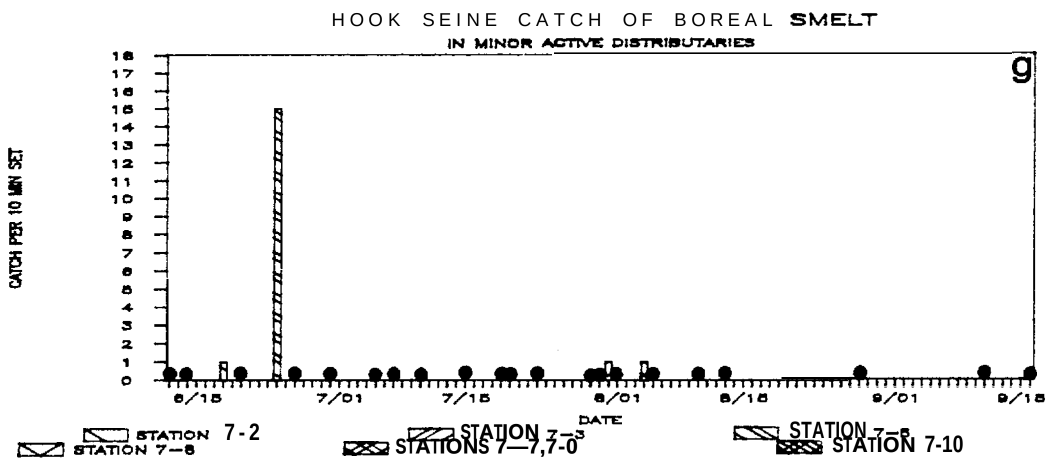


Figure 4-14. Catch Per Unit Effort of Boreal Smelt in (g) Minor Active Distributaries.

(●) = Effort but no catch.

hour single fyke net sets in the mud flats, from the coastal sloughs with tidal net sets, and in 10-minute hook seine sets in minor active distributary habitats (Figures 4-14d, e, f, and g).

Pond Smelt

Pond smelt were not as abundant as boreal smelt but were collected in most of the same habitats (Table 4-10). The greatest number of pond smelt were caught in September, followed by August, and only a few in June and July. During June and July, pond smelt were absent from all habitats except the tidal slough (Figure 4-15) and the minor active distributaries. In contrast, pond smelt were present in all habitats except the tidal slough during August and September.

The 10-minute purse seine sets in the delta front produced the most pond smelt (Figure 4-15a). In this habitat the CPUE in three different seine sets yielded 51 to 116 fish. Purse seine sampling effort in the mid-delta platform and major active distributaries produced only low catches, as did the single fyke net sets in the mudflat habitats (Figures 4-15b, d, and f). The double fyke net sets in the inner delta platform produced 10w CPUE, the largest being 18 fish. A CPUE of 53 fish occurred in one 24 hour tidal net set in the coastal sloughs, and this was the only substantial catch from this habitat (Figure 4-15e). One of the hook seine sets in the minor active distributary habitats produced a CPUE of 32 fish (Figure 4-15g).

Unidentified Smelt

A total of 1,869 unidentified smelt were taken from four habitats which were representative of the delta platform and active distributary environments (Table 4-10). These smelt were likely composed of juvenile pond and/or boreal smelt which were migrating downstream. The majority of the unidentified smelt were caught in August (1,778 fish) and most were taken from the minor active distributary habitat with hook seine sampling gear (Figure 4-16). Few were taken from the major active distributaries with the purse seine (Fig. 4-16 c and d).

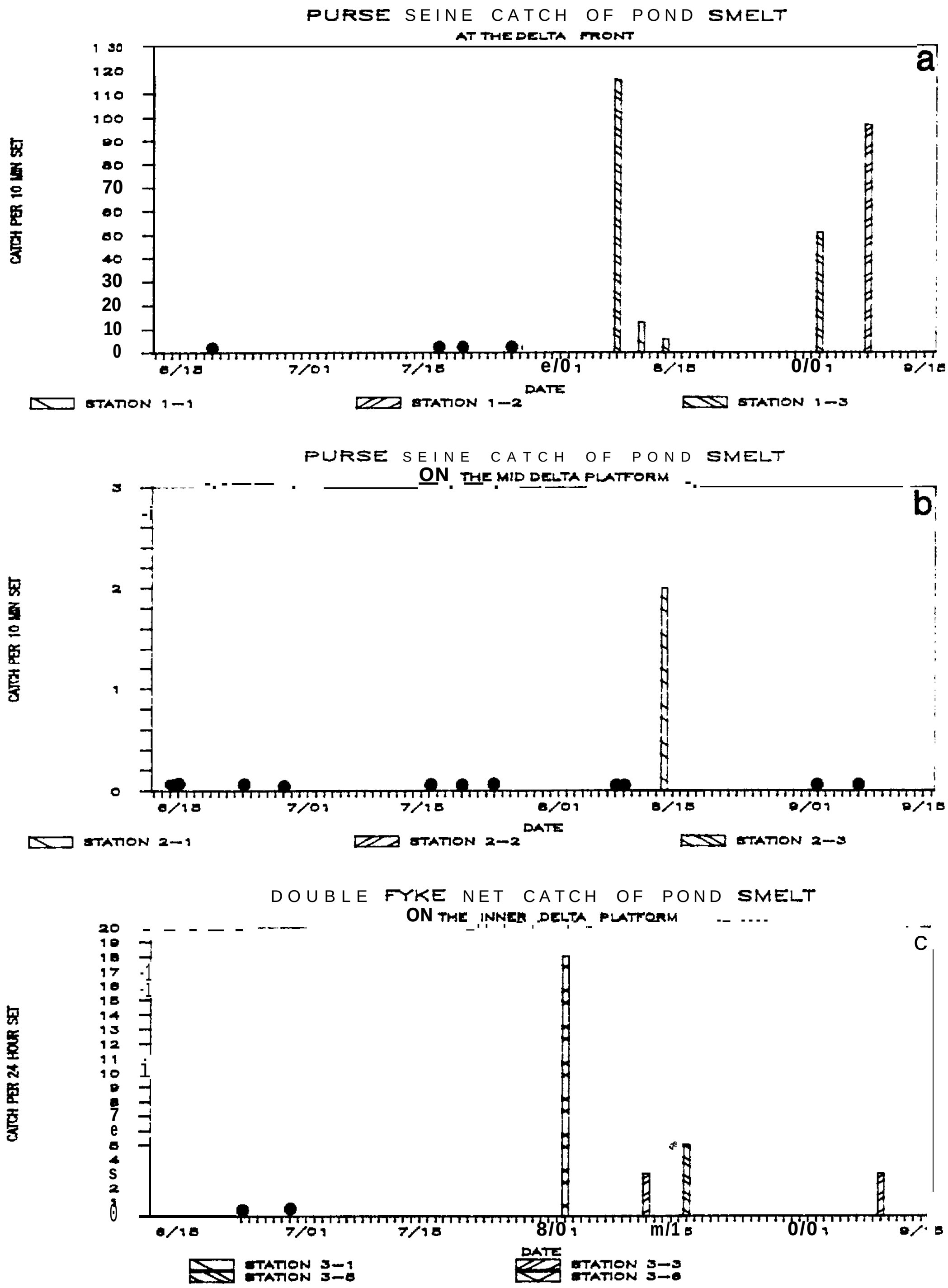


Figure 4-15. Catch Per Unit Effort of Pond Smelt in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(●) = Effort but no catch .

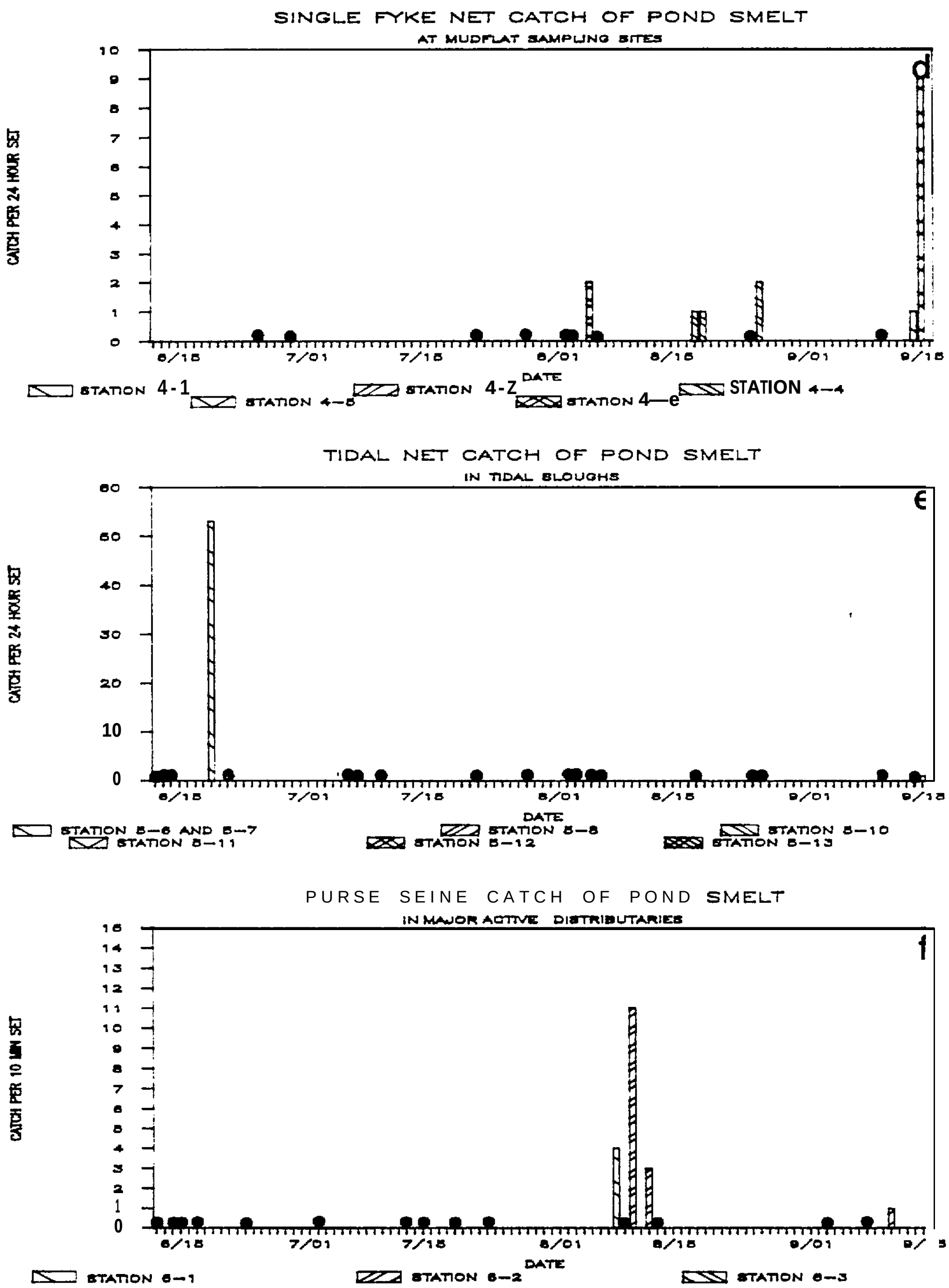


Figure 4-15. Catch Per Unit Effort of Pond Smelt in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Major Active Distributaries.

(●) = Effort but no catch.

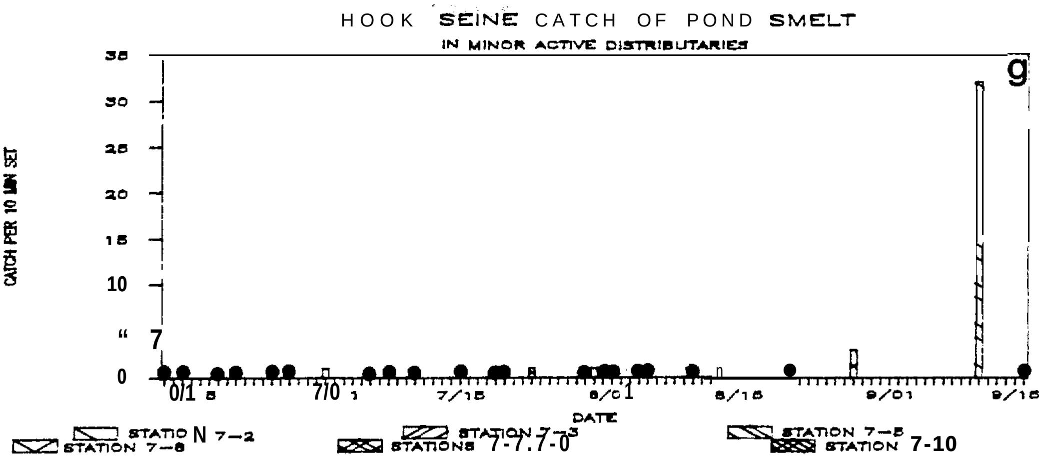


Figure 4-15. Catch Per Unit Effort of Pond Smelt in (g) Minor Active Distributaries.

(⊙) = Effort but no catch.

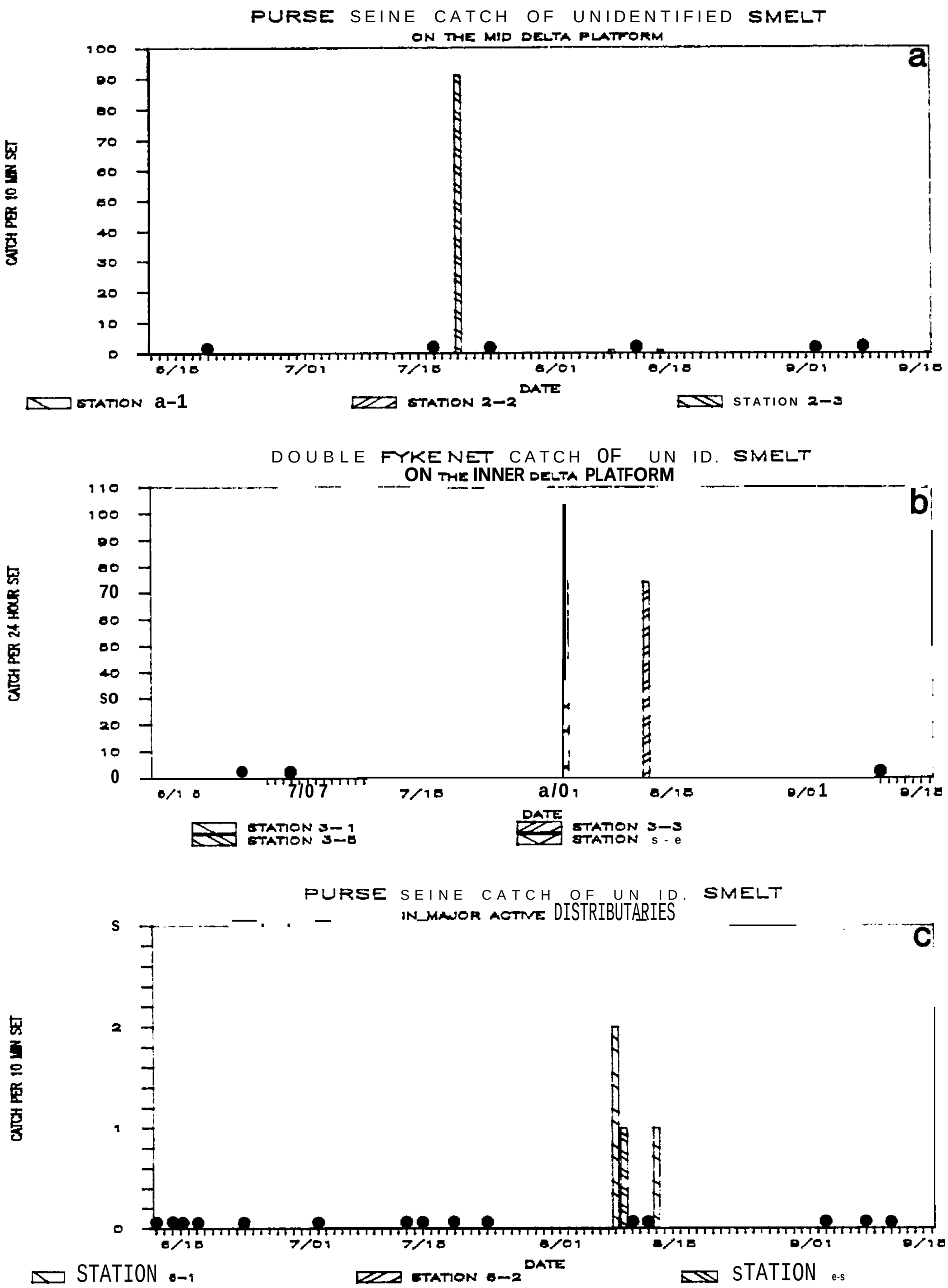


Figure 4-16. Catch Per Unit Effort of Unidentified Smelt in (a) Mid Delta Platform, (b) Inner Delta Platform, and (c) Major Active Distributaries.

(●) = Effort but no catch.

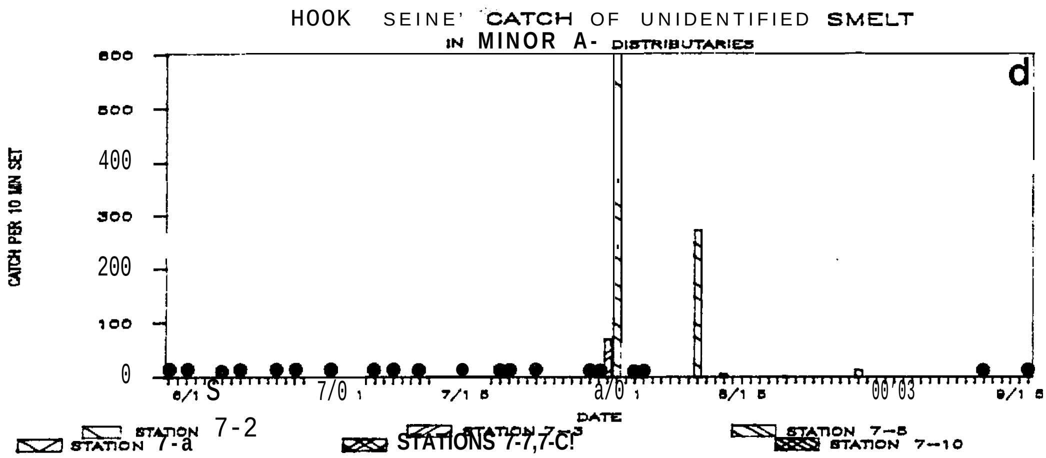


Figure 4-16. Catch Per Unit Effort of Unidetnfied Smelt in (d) Minor Active Distributaries.

(●)=Effort but no catch.

Double fyke nets in the inner delta produced a CPUE of 74 and 103 fish on two separate 24-hour sets (Fig. 4-16d). Catches of un-identified smelt were not recorded because most fish after early August were not large enough for positive identification at this time.

NinesDine Sticklebacks

This species was the most ubiquitous of the non-salmonids surveyed during the summer of 1985. A total of 2,926 fish were found in 10 of the 13 habitat types surveyed (Table 4-10). Sticklebacks were most abundant in the nearshore and offshore habitats, and the greatest catches occurred during August and September (Appendix B).

Arctic Lamprey

A total of32 Arctic lamprey were taken during the summer. None were taken after July and all were collected from active distributary, coastal, and offshore habitats (Table 4-10).

Longnose Sucker

The longnose sucker was one of the most omnipresent non-salmonid species caught through the summer of 1985. A total of 106 suckers were found in 8 of the 13 habitat types surveyed (Table 4-10). Most of the suckers from the mudflats, coastal sloughs, and minor active distributaries were caught in August. The suckers from the minor and major inactive distributaries were caught in June.

Northern Pike

The northern pike was widely distributed and was found in the same habitats as were the longnose sucker. A total of 102 pike were found in 8 of the 13 habitat types surveyed (Table 4-10). The greatest number of pike were caught in August (45 fish), followed by 31 in July and 26 in June. No pike were caught in September.

Burbot

Burbot were widely distributed among inner delta and coastal habitats (Table 4-10). Most of the burbot from the inner delta, lake outlet, coastal sloughs, and mudflats were taken in August. The majority of burbot taken from a minor active distributary were caught in July (770 fish), and a small number (174) were taken in August.

The purse seine sampling gear produced small catches of burbot in the major active distributaries (Figure 4-17). Relatively small catches were produced from 24-hour single fyke net sets in the mudflats and minor inactive distributaries, from tidal net sets in the coastal sloughs, and lake outlet traps. The largest CPUE of burbot occurred in the minor active distributaries where seven different 10 minute hook seine sets produced 20 to 146 fish. Several other sets in this habitat yielded smaller CPUE. The CPUE in the inner delta platform was dominated by one double fyke net set that produced 53 fish.

Alaska Blackfish

The majority of the blackfish were caught in the lake outlet channel or the landlocked lakes. Most fish were caught in August.

Trout Perch

Only nine trout perch were caught throughout the summer of 1985 (Table 4-10). They were caught primarily in a lake outlet in early July. Only one was caught in a minor active distributary in late June.

Starry Flounder

Starry flounder were found in offshore, coastal and active distributary habitats (Table 4-10) . Most fish were caught in July and August, and most were caught in the mudflat and tidal slough habitats.

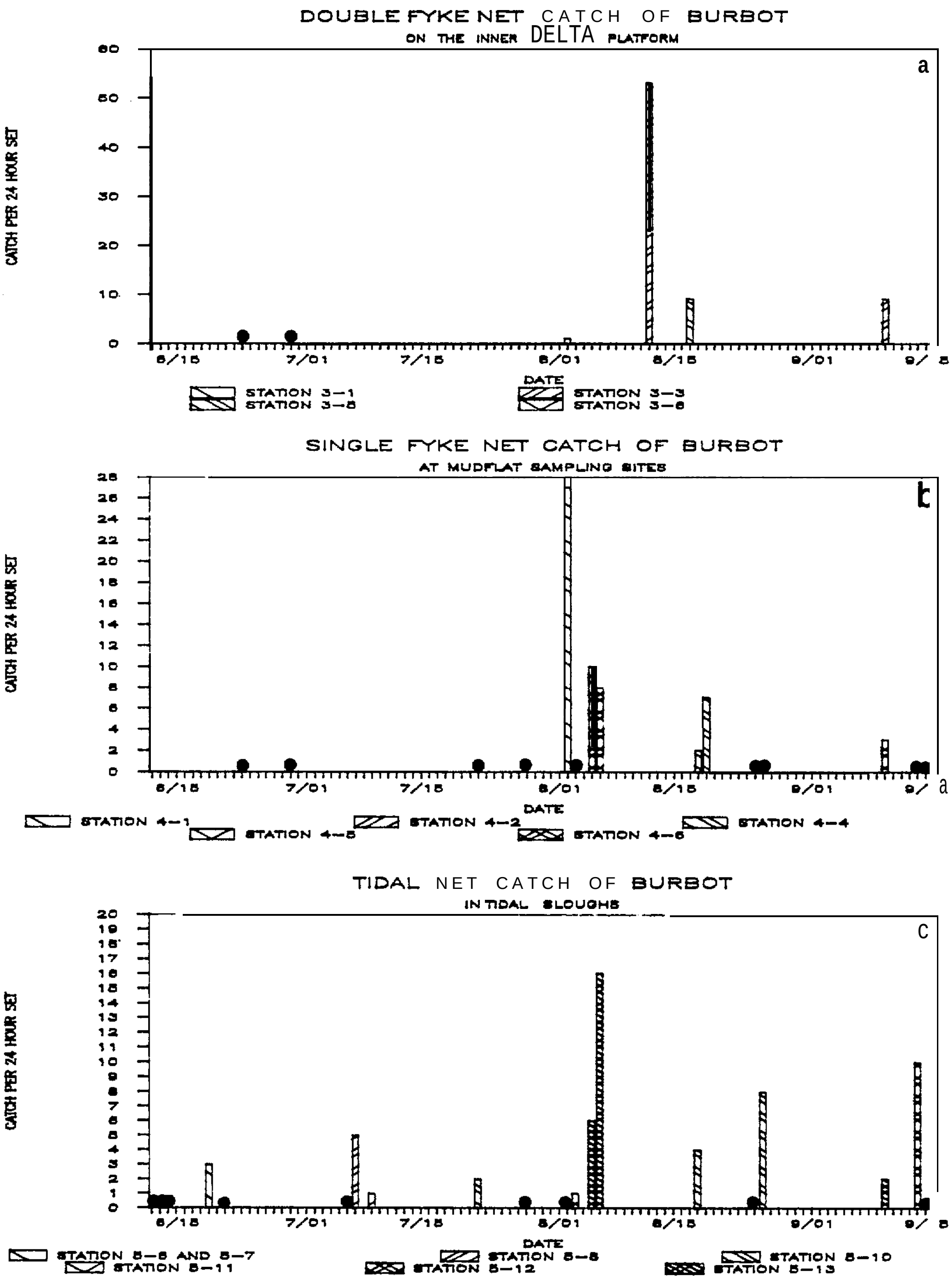


Figure 4-17. Catch Per Unit Effort of Burbot in (a) Inner Delta Platform, (b) Mudflat Sampling Sites, and (c) Tidal Sloughs.

(o) = Effort but no catch.

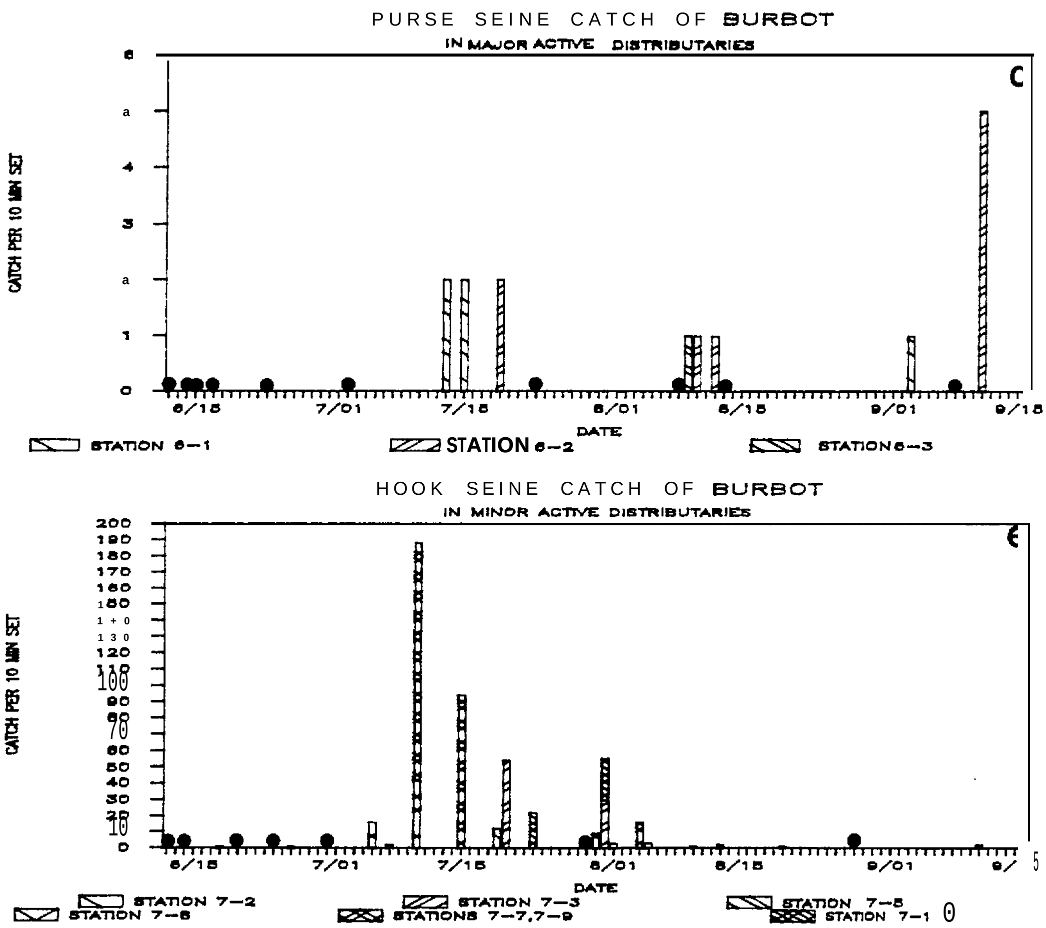


Figure 4-17. Catch Per Unit Effort of Burbot in (d) Major Active Distributaries and (e) Minor Active Distributaries.

(.) = Effort but no catch. 508

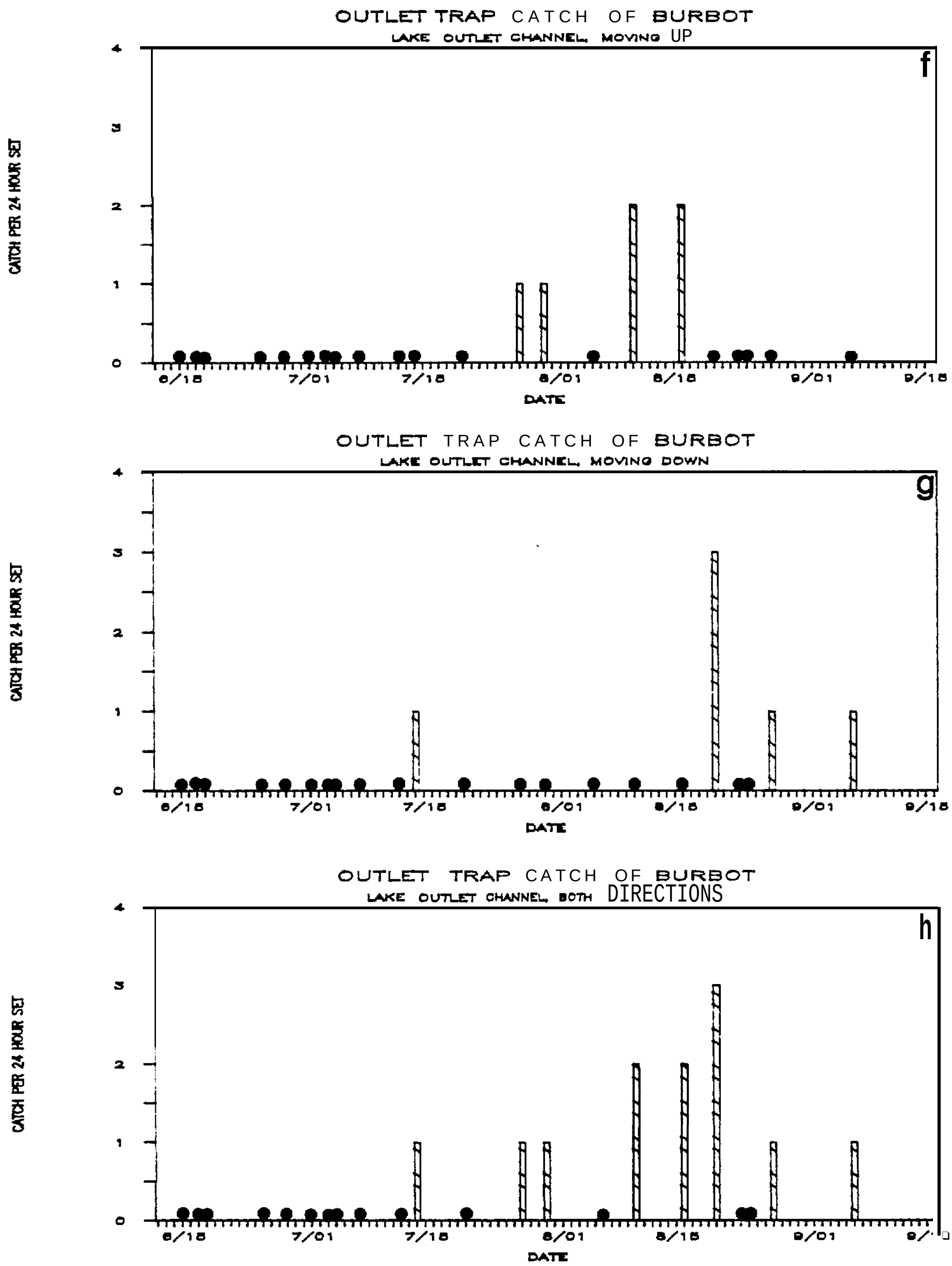


Figure 4-17. Catch Per Unit Effort of Burbot in (f) Lake Outlet Channel, Moving Up, (g) Lake Outlet'Channel, Moving Down, and (h) Lake Outlet Channel, Both Directions.

(.) = Effort but no catch.

The 10-minute purse seine sets in the mid-delta platforms and the double fyke sets in the inner delta platforms produced 10wCPUE (Figure 4-18). The hook seine sets in the minor active distributaries also produced low catches. The largest catches of starry flounder were produced from single fyke nets in the mudflat habitats. The CPUE in six different sets yielded 21 to 190 fish. The tidal net sets in the coastal slough habitats also produced a moderate number of fish. The largest tidal net CPUE from this habitat was 33 fish, and five other sets produced 7 to 30 fish.

Arctic Flounder

The distribution of Arctic flounder was similar to that for starry flounder. Flounder were caught in six habitats with the majority of the catch occurring in the nearshore environment (Table 4-10). All 8 individuals from the delta front were caught in August. Most of the fish from the mid-delta were caught in August and September. All the fish from the inner delta were taken in August. The majority of Arctic flounder taken in the mudflats and coastal sloughs were caught in July (Figure 4-19).

Low catches in the delta front and mid-delta platform were produced from 10 minute purse seine sets (Figure 4-19). Double fyke nets yielded catches of 210 and 369 Arctic flounder in 24-hour sets in two different samples of the inner delta platform. The CPUE of single fyke nets in the mud flat habitats was fairly large as 74 to 138 fish were caught in four different 24 hour sets and smaller numbers were taken in other sets. The tidal net sampling gear produced the largest catches of Arctic flounder, as 26 to 317 fish in 24-hour sets were caught on four different sets. A low CPUE was yielded by the hook seine sets in the minor active distributaries.

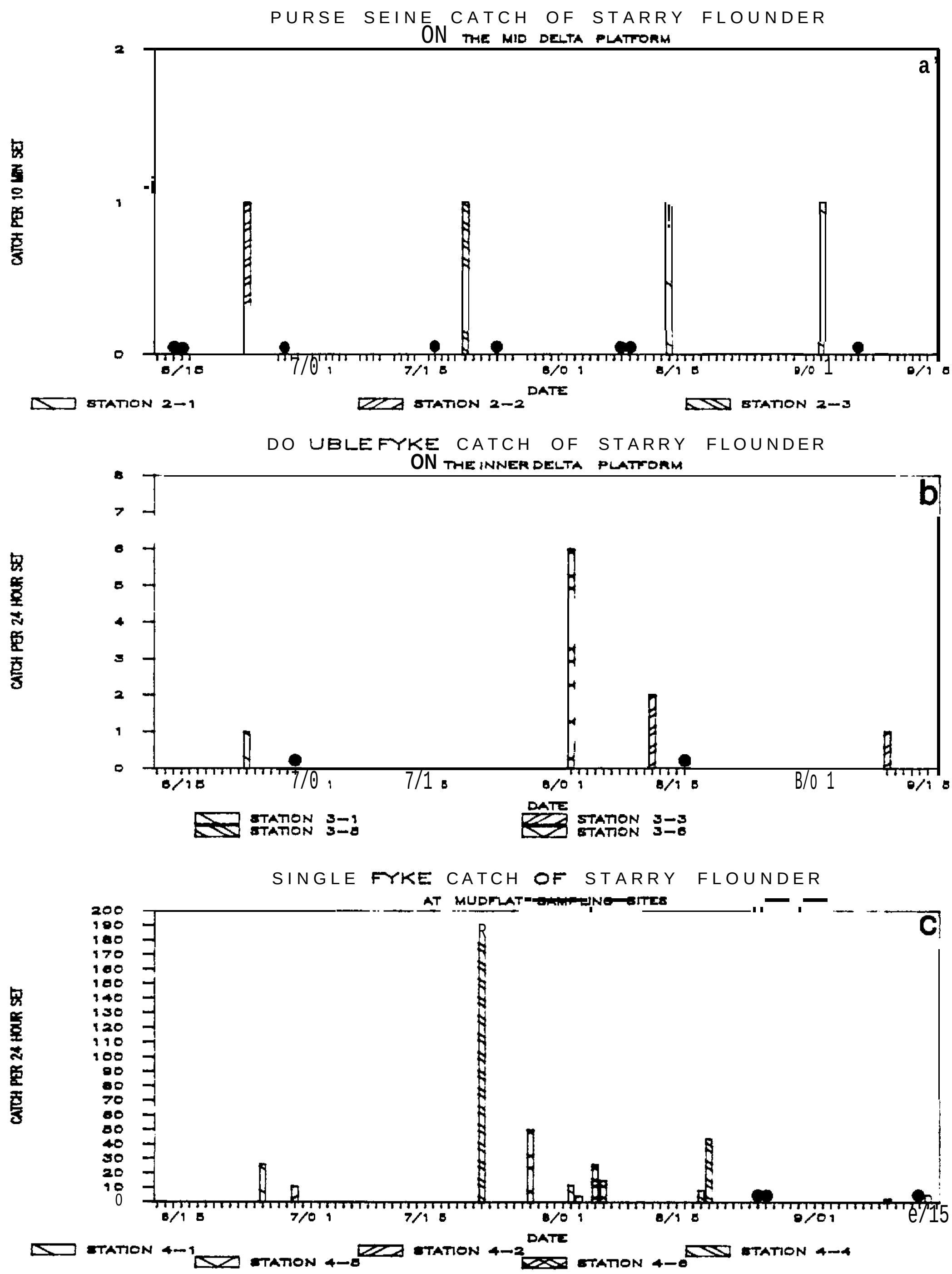


Figure 4-18. Catch Per Unit. Effort of Starry F' ounder in (a) M· d Delta Platform, [b) Inner Delta P" atform, and (c) Mudflat Sampling Sites.

(●) = Effort but no catch

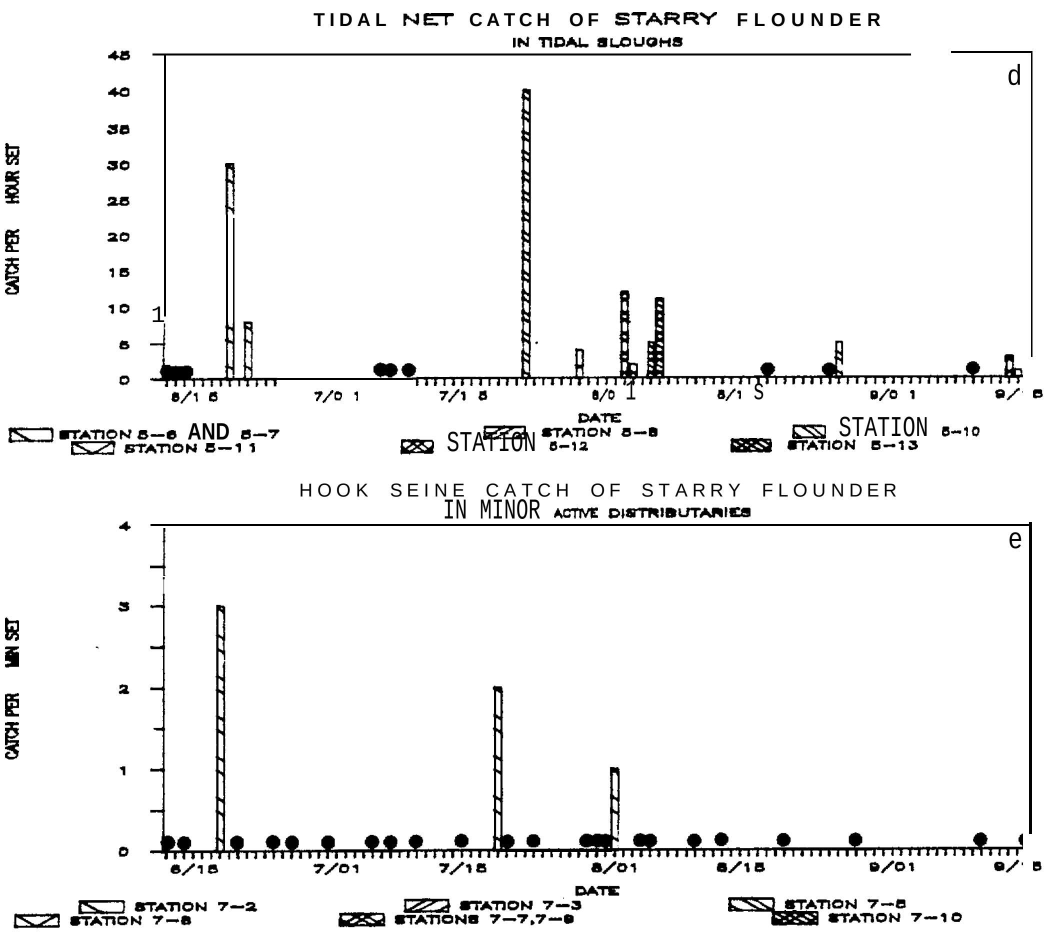


Figure 4-18. Catch Per Unit Effort of Starry F1 ounder in (d) Tidal Sloughs, and (e) Minor Active Distributaries.

(o) = Effort but no catch.

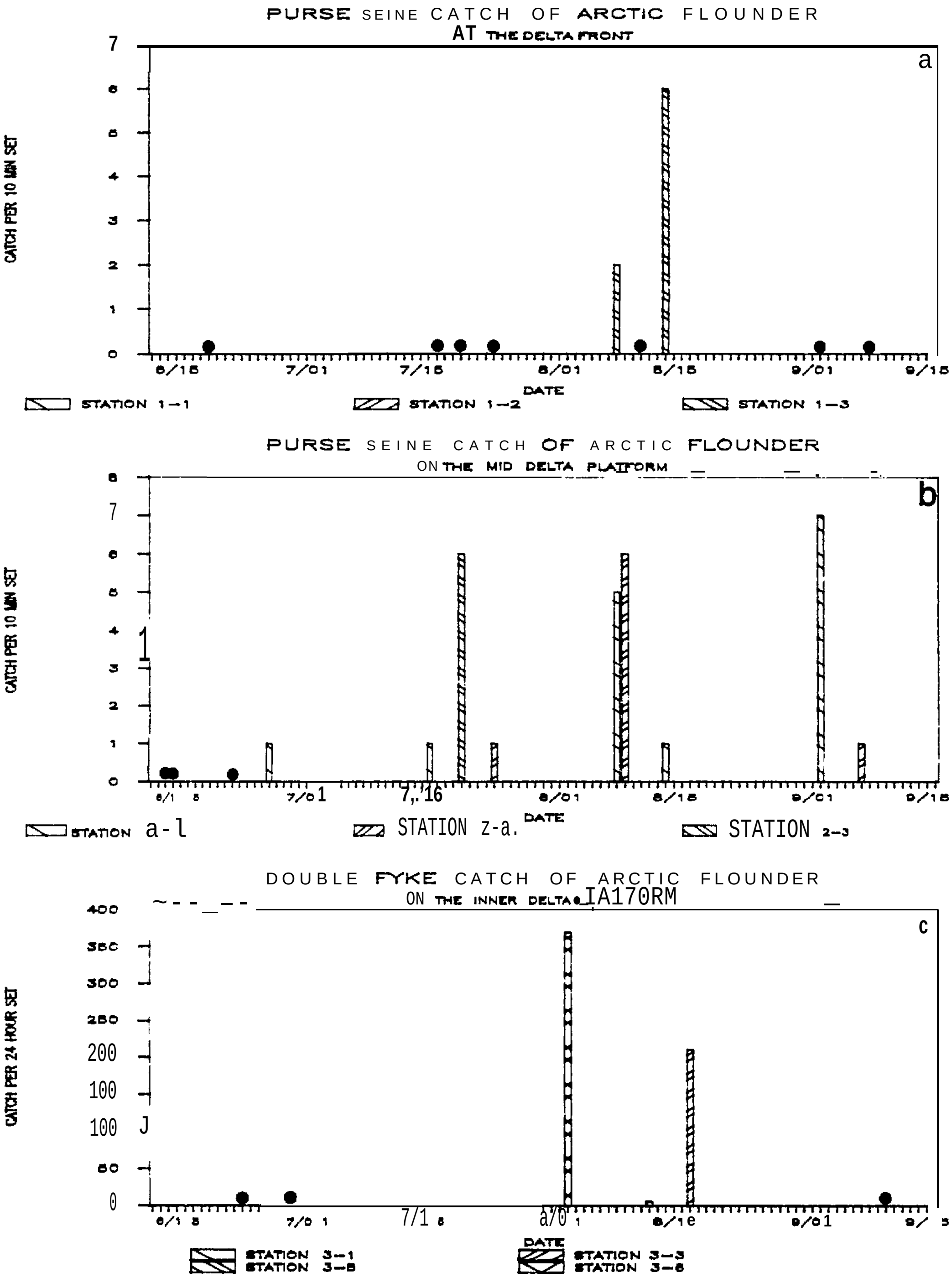


Figure 4-19. Catch Per Unit Effort of Arctic Flounder in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(●) = Effort but no catch.

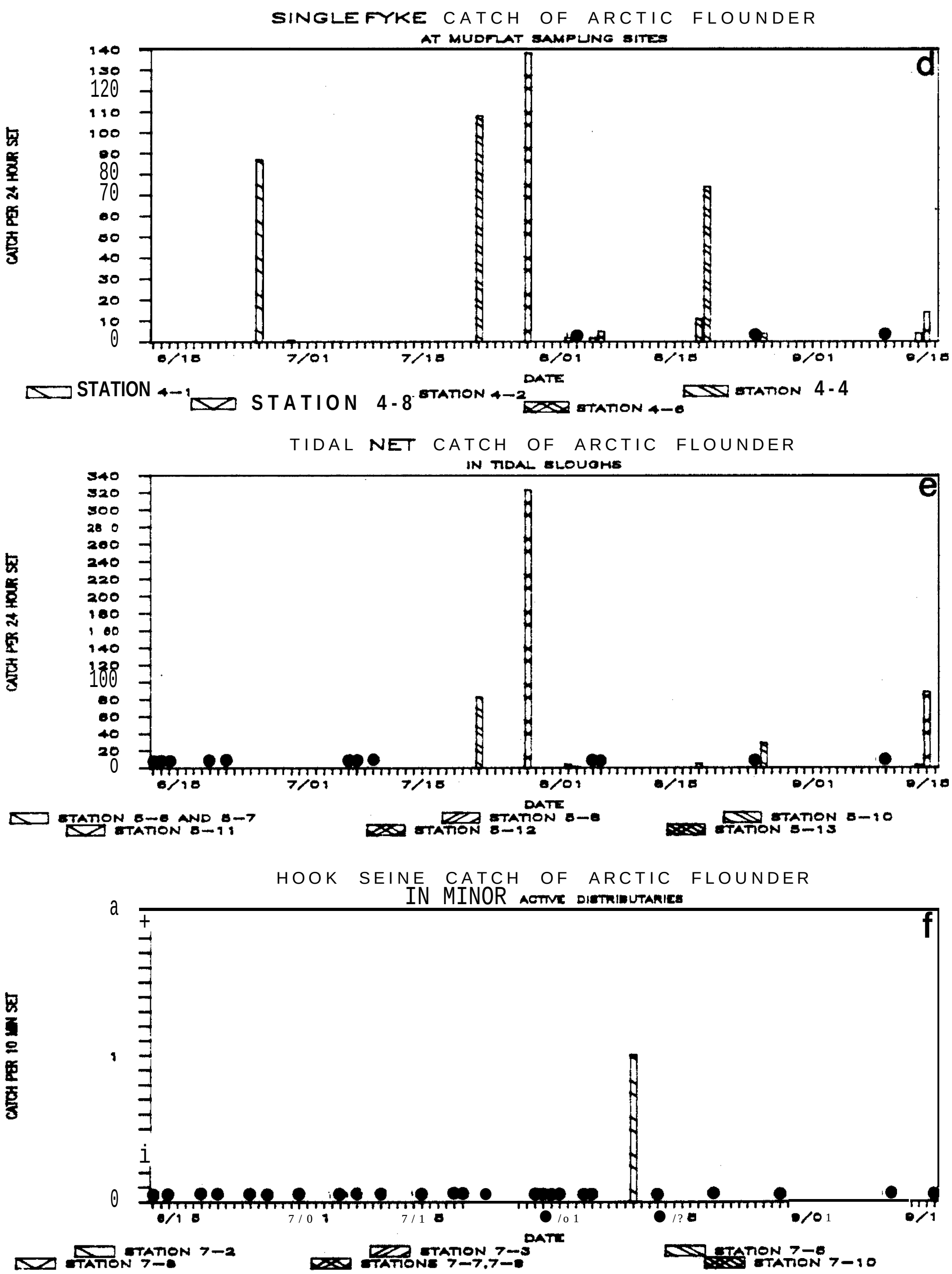


Figure 4-19. Catch Per Unit Effort of Arctic Flounder- in (d) Mudflat Sampling Sites, (e) Tidal Sloughs, and (f) Minor Active Distributaries.

(0) = Effort but no catch.

Saffron Cod

Saffron cod were taken from coastal and offshore habitats (Table 4-lo)* The majority were caught in August and September, and a small number were caught during June and July.

Purse seine samples from the delta front produced the most saffron cod, as CPUE on five different occasions ranged from 33 to 167 fish (Figure 4-20) . The largest single fyke net catches in the mudflats habitats produced catches of71 and 219 fish per 24-hour set, and five separate 24-hour tidal net sets produced CPUE's from 25 to 121 fish. The CPUE in the mid delta platform was only one fish.

Fourhorn Sculpin

Fourhorn sculpin were caught primarily in the delta platform and a small number were also caught in the delta front, coastal and active distributary habitats (Table 4-10). None were caught in July while the majority were taken in August.

Pacific Herring

Pacific herring were only caught in the delta front. The majority were caught during the latter part of July (Table 4-10). The CPUE of three separate 10-minute purse seine sets yielded 19 to 100 fish, and other sets had scattered catches (Figure 4-21).

4.4.3.2 Size Composition

Boreal Smelt

The cumulative size distribution of boreal smelt for the entire summer exhibited a single mode between 70 and 80 mm FL (Appendix C Table 2). Fish caught with all gear types and in all habitats ranged from a minimum of 40 to a maximum of 260 mm; however, only five fish exceeded 200 mm.

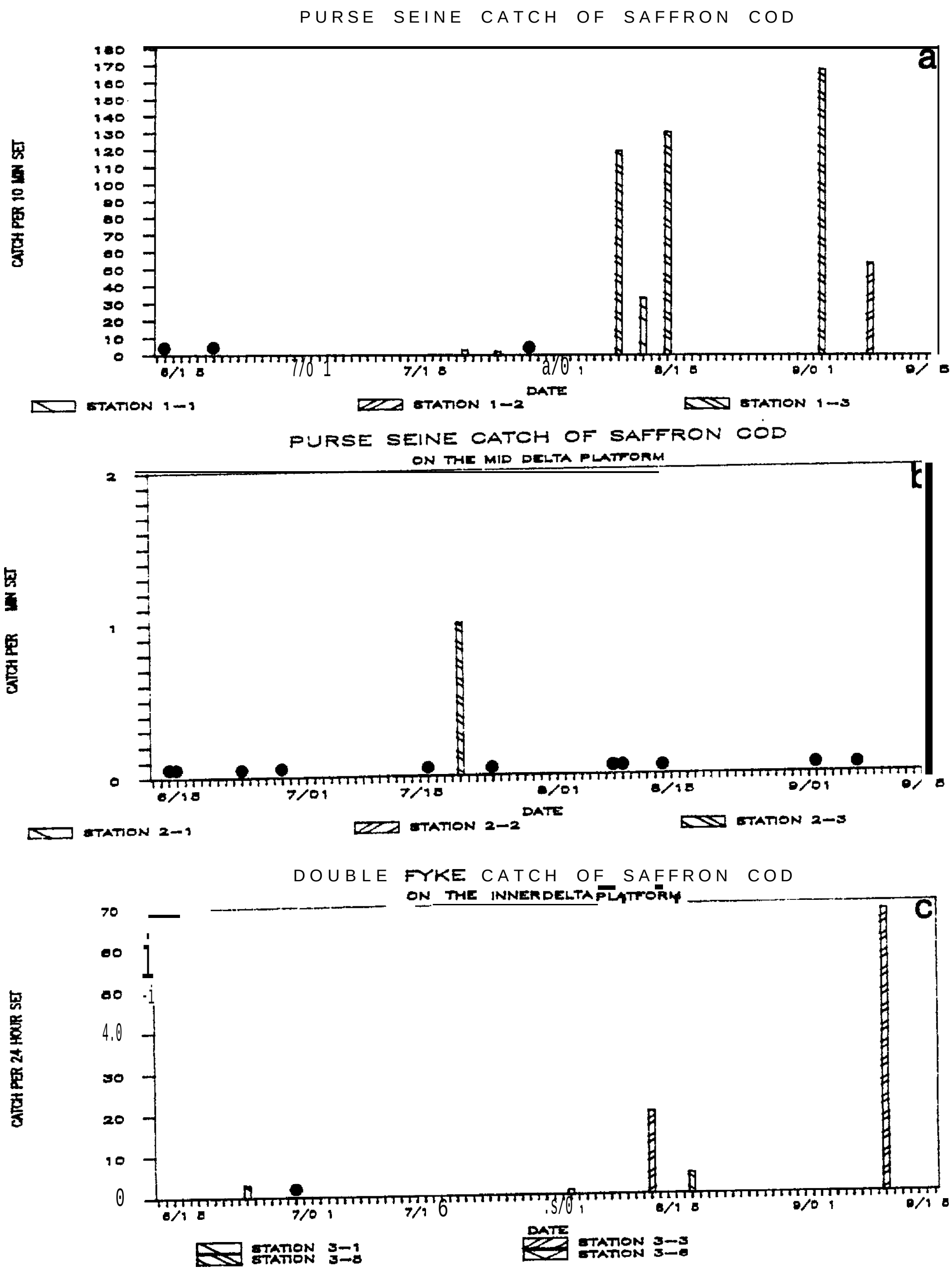
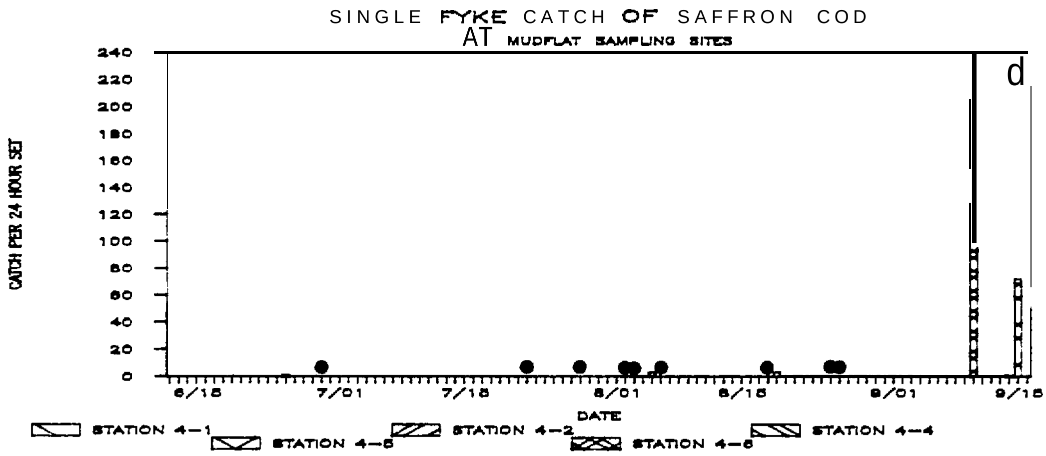


Figure 4-20. Catch Per Unit Effort of Saffron Cod in (a) Delta Front, (b) Mid Delta Platform, and (c) Inner Delta Platform.

(●) = Effort but no catch.



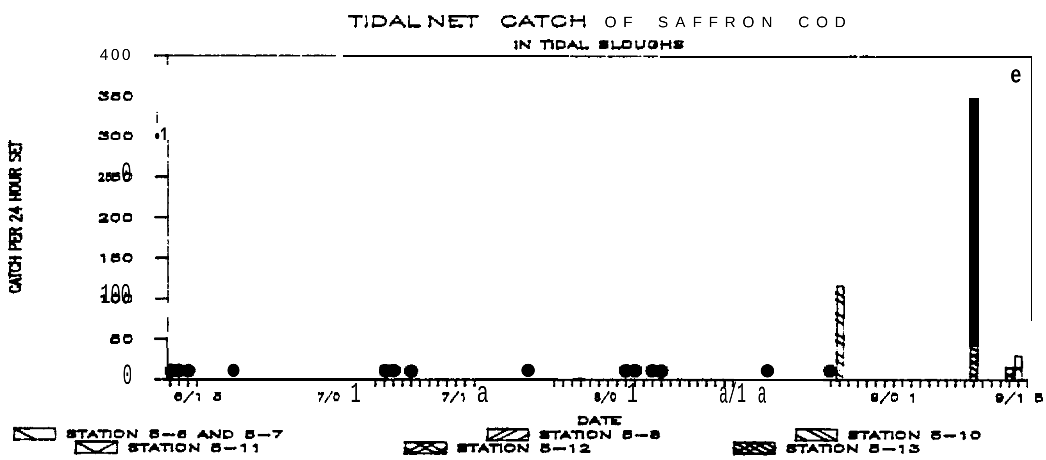


Figure 4-20. Catch Per Unit Effort of Saffron Cod in (d) Mudflat Sampling Sites and (e) Tidal Sloughs.

(0) = Effort but no catch.

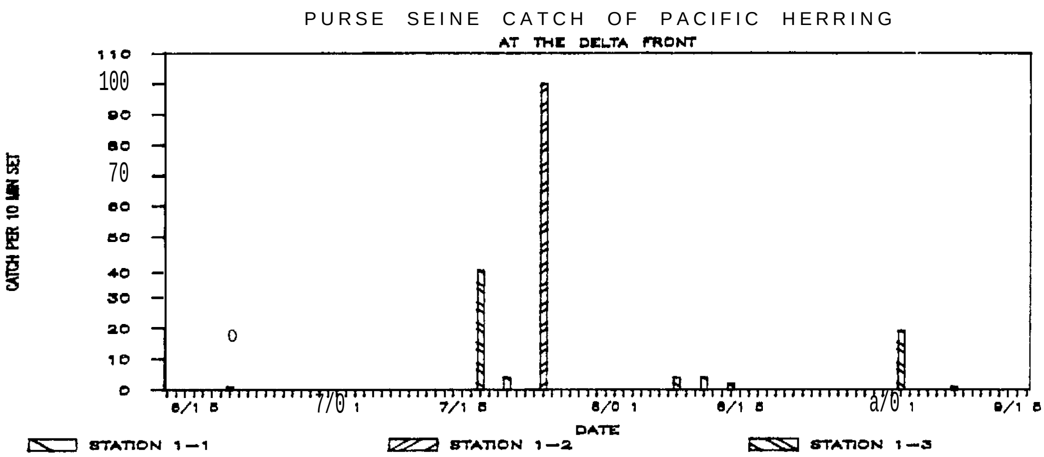


Figure 4-21. Catch Per Unit Effort of Pacific Herring in Delta Front

(●) = Effort but no catch.

Although only a single mode was discernible from the cumulative length-frequency distributions, several size classes were typically evident when data were grouped by habitat and time. In late June, at least two size classes were present in the study area. The smallest of the two ranged from 40 to 60 mm with a mode at 50 mm. The larger size class ranged from 140 to 180 mm with a mode at 160 mm. The smaller size class occurred primarily in the minor active distributaries and to a lesser degree in the coastal slough and mudflat habitats. The larger size class was found predominantly in the minor active distributary, the major active distributaries and the inner delta platform. During July two size classes were again present. The smallest group ranged from 70 to 90 mm and was found mostly within the inner delta. The largest size class was smaller than encountered in June with an overall range of 90 to 140 mm. In early August size classes of small individuals (60-80 mm) were still being collected in the inner delta platform and delta front habitats. Length-frequency histograms also suggested the presence of a second size class in the area of the delta front comparable in size to the smelt captured the previous month (90 to 120 mm) in this habitat.

All of the boreal smelt caught from 1-18 September came from the delta front. Their length-frequency distribution contained only a single discernible mode with most fish 70to 100 mm in length.

Pond Smelt

Two probable size classes of pond smelt occurred in the study area (Appendix C, Table 13). The smaller and more numerous size class ranged from about 30 to 60 mm FL and the larger smelt ranged mostly from 60 to 90 mm with a few as large as 130 mm. These larger individuals may have been part of a third or fourth size class but numerical abundances were too low to make this determination.

Unidentified Smelt

The length-frequency distribution for unidentified smelt had a single mode at 30 mm FL and a range of 20-70 mm (Appendix C, Table 14). Most fish were less than 50mm and most were caught in August. These fish represent more than a single species since juvenile and larval forms of both pond and boreal smelt were noted to co-occur at other times and locations.

Ninespine Sticklebacks

The length-frequency distribution for ninespine sticklebacks was monomodal at 30-50 mm FL with an overall range of 20-70 mm (Appendix C, Table 15). Similar size composition was noted throughout the summer at all locations.

Arctic Lamprey

Arctic lamprey ranged in size from 50 to 180 mm FL with a modal size of-120 mm (Appendix C, Table 16). Although catches were small, their overall size composition did not appear to change over the brief period (i.e., June and July) that they were present in the delta.

Unidentified lamprey (ammocoetes) which were captured in the delta were very likely this species since no other species of lamprey were present in the region.

Longnose Sucker

Longnose sucker ranged in size from a minimum of 20 mm to a maximum of 230 mmFL (Appendix C, Table 17). The largest proportion of the catch measured between 100 and 160 mm in length.

Northern Pike

Northern pike ranged in size from20 to670mm FLwith very little evidence of strong size class structure (Appendix C, Table 18).

Burbot

Burbot ranged in size from 20-790mm FL (Appendix C, Table 19). They were present in the delta over a large size range but were largely dominated by smaller individuals. The overall modal size of burbot collected from delta habitats was 30 to 40 mm.

Notable differences in size composition of burbot existed among several of the eight different habitats in which they were collected. Smaller fish were caught in the active distributaries, lake outlets, and inner delta habitats. Larger fish were most commonly encountered in the coastal sloughs, minor active distributaries and the lake outlets. Burbot collected from the inner delta and coastal mudflats were similar in size composition with small individuals (50 - 80 mm) dominating the catch and a few larger individuals ranging up to 330 mm. Individuals collected in the coastal sloughs ranged from 50 to 440 mm and were not strongly dominated by any one size class. Burbot collected in the active distributaries, both minor and major, were strongly dominated by a small size class ranging 20-80 mm. Burbot from a lake outlet ranged from 40-790 mm with a mode at60 mm. The majority were less than 100 ml.

Burbot caught from 14-30 June were broadly distributed over a range from 70 - 780 mm. One size class was evident between 70 and 130 mm but all other fish were somewhat uniformly distributed between 230 and 780 Inn. Most of the burbot came from coastal sloughs and minor active distributaries. The smaller fish (70 to 130 mm) were present only in the coastal sloughs.

Burbot sampled in July were mostly captured in the minor active distributaries and were typically less than 50mm in length. The predominance of smaller burbot in the minor active distributaries continued through early August. By late August and early September the proportion of small burbot in our samples had declined substantially. The fish captured towards the end of the summer ranged from 50 - 670mm with individuals of 60 to 80 mm still being most numerous.

Alaska Blackfish

Blackfish ranged in size from 50-160 mm FL (Appendix C, Table 20). Size composition was notably different within the two habitats in which this species was most abundant. Blackfish in the lake outlet channels were mostly 90 mm or less, whereas blackfish collected in the landlocked lake were primarily 90mm or greater in length.

Trout Perch

Trout perch ranged in size from 30-40 mm FL (Appendix C, Table 21). The sole trout perch caught in a minor active distributary in late June measured 40 mm.

Starry Flounder

Only a single size class was discernible in their cumulative length-frequency distribution for starry flounder. Their modal size was between 140-150 mm FL with an overall range of 30-250 mm (Appendix C, Table 22).

Although starry flounder were present in five different habitats, they were abundant in only two -- the coastal mudflats and sloughs. Fish occupying these two habitats were similar in size composition. Most individuals ranged from 100 - 180 mm.

The modal size of starry flounder increased slightly over the course of the summer. In late June a single, although small, mode occurred at 120 nun. By late July the mode had increased to between 140 and 150 mm and one month later was between 160 and 170 mm.

Arctic Flounder

The overall length-frequency distribution for arctic flounder was monomodal at 80 mm FL with a size range of 20-200 mm (Appendix C, Table 23).

A distinct spatial gradient in size composition was evident for this species. Larger fish were captured offshore in the vicinity of the delta front while smaller individuals were more common in the coastal habitats. Flounder collected from the mid delta platform were primarily from a larger size class (130 to 200mm; mode= 140 mm). Fish captured in the inner delta and on the mudflats were similar in size composition and consisted of at least two size classes. The smaller size class collected in the mudflat habitat was notably smaller than its counterpart in the inner delta. At least two size classes were captured in the coastal sloughs. The most numerous size class consisted of the smallest fish collected in the study area. This group ranged from 20 to 50 mm with a mode of 30 mm. The second size class occurred between 50 and 90 mm with a mode of 80 mm. A possible third size class measured 90 to 110 mm with a mode of 100 mm.

Substantial temporal changes in size composition of Arctic flounder occurred over the course of the summer. In June, the largest percentage of flounders ranged from 50 to 60mm were caught almost exclusively in the mudflat habitat. During the last two weeks of July, flounders were found in both the mudflat and coastal slough habitats. Those collected in the mudflat were all greater than 100 mm while fish captured in the slough were dominated by individuals that were less than 100 mm. Within the coastal sloughs, two size classes were present that were under 100 mm. The larger of the two ranged from60 to 90mm with a mode of 70 mm. This group was believed to correspond with the

50 to 60 mm size class found over the mudflats in June. The presence of the smaller size class (20 to 30 mm) in the sloughs marked the first occurrence of this size class in the study area. At the end of the summer larger size classes were not distinct due to decreases in overall catch. Fish collected in the coastal slough habitat, however, were notably smaller than fish from either of the other two habitats (mid delta platform and coastal mudflats) from which flounder were collected.

Saffron Cod

The cumulative length-frequency distribution was monomodal at60 mm FL with a range of 50-390 mm (Appendix C, Table 24).

Between June and July few cod were present in the the delta study area but those captured during were relatively large individuals. Cod caught during 14-30 June came from the inner delta, mudflats, and a coastal slough habitat and ranged from 190-300 mm. Those from 16-31 July were from the delta front, mid-delta, and a coastal slough habitat and had a range of 110-260 mm. Cod caught from 1-15 August came mostly from the delta front, ranging in size from 50-260 mm. The majority of these fish measured 60 mm. Fewer fish were caught in the inner delta and ranged in size from 60-240 mm with only two greater than 100 mm. The fewest numbers of fish caught during this period were from the mudflats and ranged in size from 120-300 mm.

During late August larger saffron cod were found in the coastal sloughs and mudflats. Smaller, although fewer, individuals were captured further offshore on the delta platform. Most of the cod caught during 16-31 August came from coastal sloughs and ranged from 210-320 mm with the majority measuring 260-280 mm. Cod from the mudflats ranged from 240-280 mm. Fewer fish were caught in the delta front and ranged from 60-270 mm with a single mode at 70 mm. Mid-delta cod measured 60-70 mm.

By September when saffron cod were most abundant strong spatial differences became evident in the size structure within the study area. The cumulative length-frequency distribution from 1 to 18 September was monomodal at80 mm, but ranged from 70-390 mm. Cod collected in the coastal sloughs were distinctly larger than those collected in other habitats. They ranged in size from 130-380 mm with only two individuals less than 200 mm. Most of the fish measured 250-280 mm. Cod collected from the mudflats were similar in size and ranged from 140-390 mm with the majority between 260 and 280 mm. Fish captured in the delta front were markedly smaller with a mode of 80 mm and range of 70 to 110 mm.

Fourhorn Sculpin

Fourhorn sculpin ranged in size from40 - 200mm FLwith a distinct mode between 90 and 110 mm (Appendix C, Table 25). Fish collected in the region of the mid delta platform were generally larger than fish from the inner delta platform; however, this is more likely a reflection of sampling gear than actual size differences.

Pacific Herring

Pacific herring ranged in size from 50-200 mm FL (Appendix C, Table 26). Fish caught in July ranged 80-110 mm and by September fish ranged 110-120 mm.

4.5 FOOD HABITS

4.5.1 Samples Collected and Analyzed

Fish stomach contents samples were collected from approximately half of the 54 locations sampled across the delta. Most of the samples originated from minor active distributaries (21%), coastal sloughs

(18%), major active distributaries (17%), and delta front (17%) habitats (Table 4-13); no samples were obtained from minor inactive distributaries, lakes, or lake outlets.

Of the 456 total stomach samples analyzed, approximately 41 percent originated from fyke net collections, 40% from purse seine collections, and the remainder from beach seine collections (Table 4-14).

Of the total stomach sample size, 116 (21.2%) of the stomachs were empty. In all further discussion of diet composition, quantification of prey taxa as a frequency or proportion of the total sample refers to only those stomachs containing food items.

4.5.2 Composite Diet Descriptions

Summary tabulation of the composite (for the species overall) diet composition of the eleven selected fish species, as discussed in the following section, is included in Appendix D. These tables describe the stomach contents at the finest level of taxonomic, life history, and organism parts identified. Diet composition, based on the %SIRI irrespective of prey organism part or life history stage, is summarized for the eleven species in Table 4-15.

Bering Cisco

Calanoid copepods (74.5%SIRI) and the mysid Neomysis sp. (23.3%SIRI) dominated the IRI prey spectrum of Bering cisco (Figure 4-22). Calanoids, which occurred most frequently (73.7%) and accounted for almost all the prey abundance (92.0%), although not specifically identifiable, appear to be marine and estuarine pelagic types. Although not as frequently consumed (26.2%) or as numerically prominent (5.9%), the epibenthic estuarine mysid, Neomysis sp., provided most

TABLE 4-13

HABITAT ORIGINS (NUMBER OF COLLECTIONS) OF JUVENILE SALMONIDS AND NON-SALMONIDS CAPTURED ON YUKON RIVER DELTA, JUNE-SEPTEMBER 1985, WHICH WERE UTILIZED FOR STOMACH CONTENTS ANALYSES

	Fish Taxa a/											
Habitat	BRC	LSC	HBW	PKS	CHS	COS	CNS	SHE	PSM	BSM	BUR	Total
delta front	3	1		2	2				3	6		17
mid-delta platform	1			2			3		1			7
inner delta platform		1	1			1	1	2	1	2	1	10
mudflat	1	3	5					3				12
coastal slough		4	6	1	1			3	1		2	18
major active distributary		2	4	2	5	1		2			1	17
minor active distributary		2	2	3	5	1	1	3	2		2	21
minor inactive distributary												
lake												
lake outlet												
Totals	5	13	18	8	15	3	2	16	7	9	6	102

a/ BRC = Bering cisco; LSC = least cisco; HBW= humpback whitefish group; PKS = pink salmon; CHS = chum salmon; COS = coho salmon; CNS = chinook salmon; SHE = sheefish; PSM = pond smelt; BSM = boreal smelt; BUR = burbot

TABLE 4-14

SUMMARY OF FISH SAMPLES ANALYZED FOR DIET COMPOSITION OF
YUKON RIVER DELTA FISI-IES, JUNE-SEPTEMBER 1985

Species-Common Name	Collection Gear Fyke Net	Purse Seine	Beach Seine	Total Sample Size	Number Empty	Percent Empty (%)
Bering cisco	5	15	0	20	1	5.0
Least cisco	48	22	10	80	15	18.8
Humpback whitefish	66	23	10	99	31	31.3
Pink salmon	2	12	19	33	7	21.1
Chum salmon	5	47	30	82	13	15.9
Coho salmon	1	1	3	5	1	20.0
Chinook salmon	3	0	6	9	3	33.3
Sheefish	54	24	16	94	28	29.8
Pond smelt	10	27	0	37	3	8.1
Boreal smelt	16	42	0	58	10	17.2
Burbot	14	5	10	29	4	13.8
Total	224	218	104	546	116	21.1

TABLE 4-15

OVERALL IMPORTANCE (%SIRI) OF PREY TAXA (IRRESPECTIVE OF LIFE HISTORY STAGE) OF ELEVEN SPECIES OF JUVENILE SALMONIDS AND NON-SALMONID FISHES CAPTURED ON YUKON RIVER DELTA, JUNE-SEPTEMBER 1985

Prey Taxa	Fish Taxa [a]										
	B RC	LSC	HBW	PKS	CHS	Cos	CNS	SHE	PSM	BSM	BUR
Rotifera			0.3								
Nematoda											
Annelida											
Polychaeta									+	+	
Oligochaeta											
Mollusca											
Bivalvia	+[b]										
Arachnida											
Araneae		-[c]									
Atari na											
Crustacea											
Notostraca									0.5		
Cladocera											
Daphnidae											
Daphnia sp.					0.1			0.8			
Bosminidae											
Bosmina sp.		0.1	0.4						0.1		
Polyphemidae											
Podon Sp.	+									0.2	
Chydoridae			-								
Ostracoda		-	0.8								5.4
Calanoida	74.5	24.9	7.5	16.8	1:3			1.8	88.9	50.9	0.1
Temori dae											
Epischura sp.				0.9	0.8	1.7		0.2			
Eurytemora sp.		11.8	2.9						+	-	1.2
Pontellidae											
Epilabidocera longipedata									0.1	0.1	

TABLE 4-15 (Continued)

OVERALL IMPORTANCE (%SIRI) OF PREY TAXA (IRRESPECTIVE OF LIFE HISTORY STAGE) OF ELEVEN SPECIES OF JUVENILE SALMONIDS AND NON-SALMONID FISHES CAPTURED ON YUKON RIVER DELTA, JUNE-SEPTEMBER 1985

Prey Taxa	Fish Taxa [a/] BRC	LSC	HBW	PKS	CHS	COS	CNS	SHE	PSM	BSM	BUR
Harpacticoida	0.1	3.0	20.7	0.8	0.2				4.6	0.1	
Tachidiidae											
Tachidius sp.		35.0	10.3								
Canthocamptidae				0.1							
Cyclopoida		4.7	8.4	13.0	5.4			3.5	1.3	6.6	
Monstrilloida											
Monstrillidae											
Balanomorpha	+								+	0.1	
Mysidacea											
Mysidae	+	0.1	0.5					3.3	0.6	25.4	3.9
Neomysis sp.	23.3	2.5	0.5					67.4	0.2	0.7	61.5
Isopoda											
Valifera											
Odoteidae											
Saduria entomon					0.3	27.4	88.1				0.2
Bopyridae	+										
Amphipoda											
Gammaridea		1.0	0.2		+					0.2	
Gammaridae					+						
Atylidae											
Atylus sp.											
Haustoriidae	1.8	6.3	42.5					14.2	2.6	0.1	0.4
Hyperiidea										+	
Decapoda											
Penaeidea		0.1	0.2								
Caridea										0.2	
Crangonidae	0.1							0.2	0.8		
Brachyura											
Insects		0.7			0.4				+		
Collembola			0.3	0.1	0.3						
Ephemeroptera											
Heptagenioidea											
Heptageniidae								0.1			
Plecoptera					1.2	1.9	2.9	-			
Psocoptera											

TABLE 4-15 (Continued)

OVERALL IMPORTANCE (%SIRI) OF PREY TAXA (IRRESPECTIVE OF LIFE HISTORY STAGE) OF ELEVEN SPECIES OF JUVENILE SALMONIDS AND NON-SALMONID FISHES CAPTURED ON YUKON RIVER DELTA, JUNE-SEPTEMBER 1985

Prey Taxa	Fish Taxa [a] BRC	LSC	HBW	PKS	CHS	COS	CNS	SHE	PSM	BSM	BUR
Insecta (Continued)											
Thysanoptera											
Hemiptera											
Homoptera		0.1									
Cercopidea											
Cercopidae											
Psylloidea											
Psyllidae											
Aphidoidea											
Aphididae											
Coleoptera											
Staphylinoidea											
Staphylinidae					0.1						
Tricoptera			0.1								
Diptera		0.1	-		0.2						
Tipulidae		0.2			0.1						
Ceratopogonidae		1.4			0.5			-			-
Chironomidae	+	6.3	3.1	63.3	89.0		3.1	7.6	0.3		11.1
Chaoboridae											
Blephericeridae											
Simulidae											
Nematocera					0.1						
Brachycera		0.3	-								
Sciomyzoidea											
Dryomyzidae											
Drosophiloidea											
Ephydridae											
Muscoidea											
Muscidae		-									
Hymenopteran		0.3									
Tenthredinoidea											
Tenthredinidae											
Apocrita											
Chalcidoidea											
Mymaridae											
Proctotrupoidea											
Platygasteridae											

TABLE 4-15 (Continued)

OVERALL IMPORTANCE (%SIRI) OF PREY TAXA (IRRESPECTIVE OF LIFE HISTORY STAGE) OF ELEVEN SPECIES OF JUVENILE SALMONIDS AND NON-SALMONID FISHES CAPTURED ON YUKON RIVER DELTA, JUNE-SEPTEMBER 1985

Prey Taxa	Fish Taxa a/										
	BRC	LSC	HBW	PKS	CHS	Cos	CNS	SHE	PSM	BSM	BUR
Vertebrate											
Teleostei	0.2							0.72	21.5	0.7	
Clupeiformes											
Clupeidae											
Clupea harengus pallasi									0.4		
Salmoniformes											
Salmonidae											
Coregonus sp.											6.6
Oncorhynchus sp.						36.5					
Stenodus leucichthys											1.0
Gasterosteoidea											
Gasterosteidae											
Pungitis pungitius								0.1			1.2
Plants and Plant Parts						32.6	5.9				
Adjusted Sample Size(n)	19	65	68	26	69	4	6	66	34	48	25
Percent Dominance	0.61	0.21	0.25	0.51	0.80	0.31	0.78	0.48	0.79	0.37	0.40
Shannon-Weiner Diversity (H')	0.95	2.81	2.57	1.32	0.79	1.78	0.71	1.69	0.78	1.66	2.06
Evenness Index	0.27	0.53	0.52	0.42	0.15	0.77	0.35	0.36	0.18	0.38	0.49

a/ BRC = Bering cisco; LSC = least cisco; HBW = humpback whitefish group; PKS = pink salmon; CHS = chum salmon; COS = coho salmon; CNS = chinook salmon; SHE = sheefish; PSM = pond smelt; BSM = boreal smelt; BUR = burbot

b/ + = less than 0.1 %SIRI

c/ - = frequency of occurrence less than 5%, numerical and gravimetric composition less than 1%

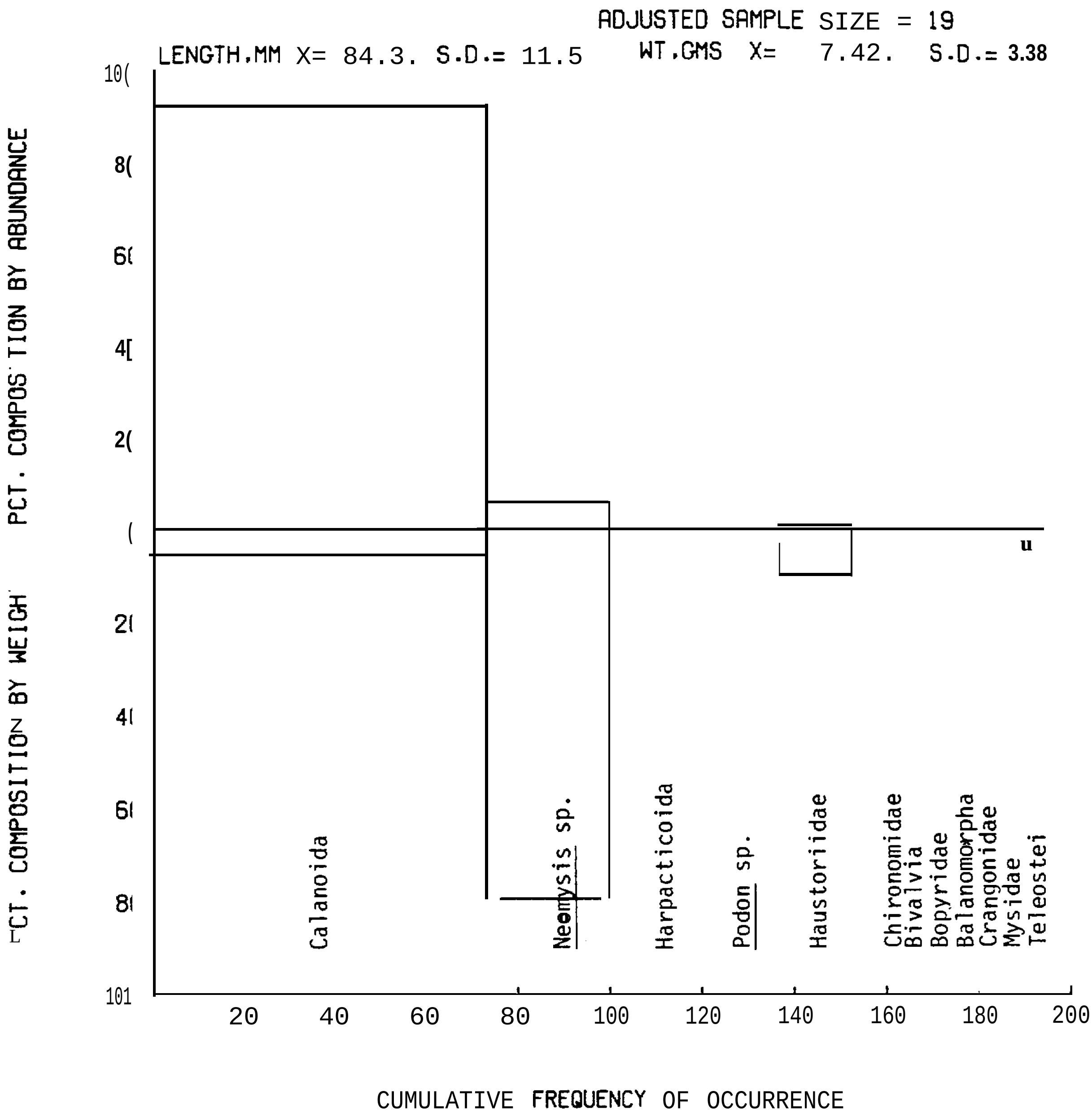


Fig. 4-22 Index of Relative Importance (IRI) prey spectrum of Bering cisco, *Coregonus laurettae*, captured in the Yukon River delta, June-September 1985.

(79.3%) of the prey biomass. The only other significant (1.7%SIRI) contribution to the diet spectrum was by haustoriid amphipods, also an epibenthic marine-estuarine taxa.

Least Cisco

Unlike the Bering cisco, the prey spectrum of least cisco (Figure 4-23) was much more diverse (H' = 2.81) and even (evenness index = 0.53), probably the consequence of the greater sample size and diversity of sample sources. The principal prey were epibenthic harpacticoid copepods (primarily the estuarine form *Tachidius* sp.), which accounted for 37.9%SIRI, and calanoid copepods (primarily the estuarine form, *Eurytemora* sp.; 36.8%SIRI). Other, less prominent prey taxa included: (1) drift insects such as adult dipteran flies (chironomids, certopogonids), 10.1%SIRI; (2) haustoriid amphipods, 6.3%SIRI; (3) cyclopoid copepods, 4.7%SIRI; and, (4) *Neomysis* sp., 2.5%SIRI.

Humpback Whitefish

The prey spectrum of humpback whitefish (Figure 4-24) is based on a relatively large sample size, and indicates rather diverse (H' = 2.57) prey resources. Numerically, epibenthic harpacticoid copepods (primarily *Tachidius* sp., 31.0%SIRI), and planktonic cyclopoid (8.4%) and calanoid (*Eurytemora* sp., 10.3%) were the more prevalent prey. But, due to its gravimetric importance (66.2% of total prey biomass), haustoriid amphipods were the singularly most important prey taxon (42.5%SIRI). Insects (both epibenthic chironomid larvae and drift adults) and other epibenthic crustaceans (e.g., mysids, ostracods) contributed less than 1%SIRI.

Pink Salmon

Chironomids, including both epibenthic larvae and drift adults, dominated (68.3%SIRI) the prey spectrum of juvenile pink salmon (Figure 4-25) due to their high frequency of occurrence (84.6%),

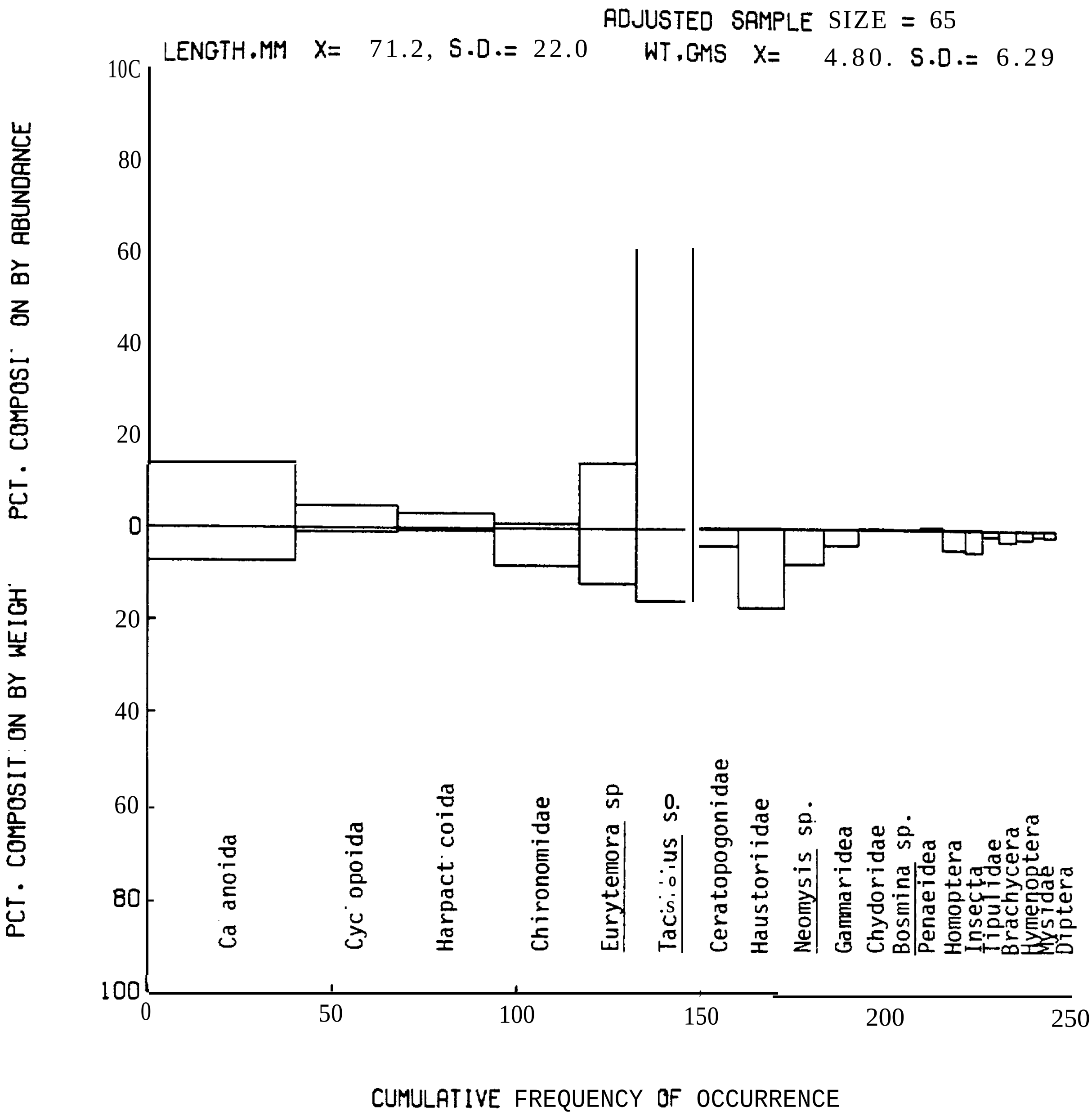


Fig. 4-23 Index of Relative Importance (IRI) prey spectrum of least cisco, Coregonus sardinella, captured in the Yukon River delta, June-September 1985.

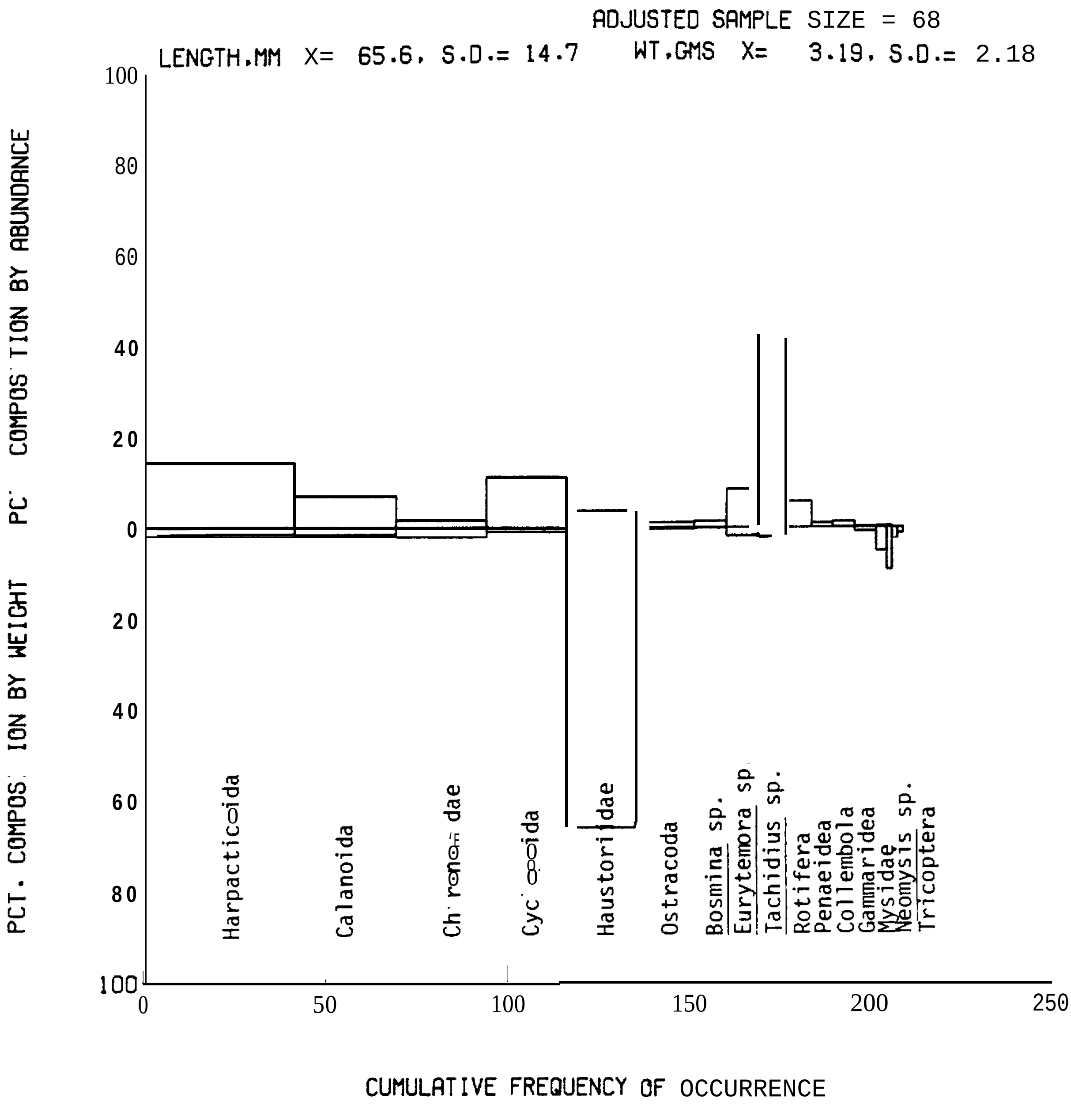


Fig. 4-24 Index of Relative Importance (IRI) prey spectrum of humpback whitefish, *Coregonus* cf *pidschian*, captured in the Yukon River delta, June-September 1985.

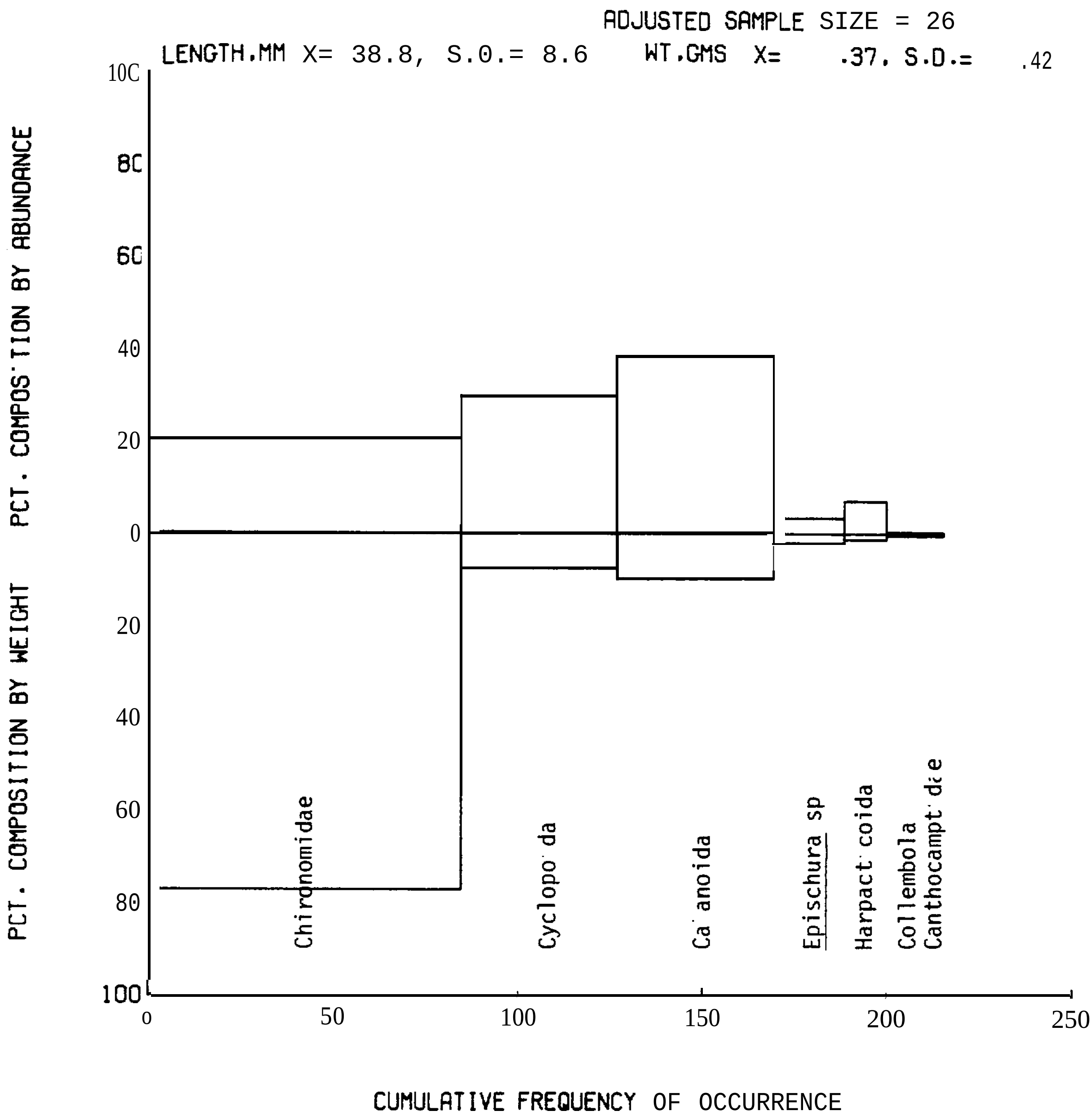


Fig. 4-25 Index of Relative Importance (IRI) prey spectrum of juvenile pink salmon, *Oncorhynchus gorbuscha*, captured in the Yukon River delta, June-September 1985.

gravimetric composition (77.2% of total prey biomass), and measurable (20.4% of total prey abundance) numerical contribution. Planktonic calanoid (17.7%SIRI) and cyclopoid (13.0%SIRI) copepods occurred frequently in the stomachs but were comparatively less important.

Chum Salmon

Despite being based on a large sample size, the prey spectrum of juvenile chum salmon (Figure 4-26) is noteworthy for its low diversity (H′ = 0.79) and overwhelming dominance (89.0%SIRI, percent dominance = 80%) by one prey taxon, chironomid insects. Although epibenthic larvae were included in this category, the vast majority of these prey were adults (Appendix D) which presumably were consumed as drift organisms. Other common prey taxa included planktonic cyclopoid (5.4%SIRI) and calanoid (2.1%SIRI) copepods and other drift insects (2.7%SIRI in aggregate).

Coho Salmon

Among the stomach contents of four juvenile coho salmon examined, three had plant material and one each contained valiferan isopods (*Saduria entomon*), plecopterans (stoneflies), other juvenile salmon, and freshwater planktonic calanoid copepods (*Epischura* sp.). As a consequence, due to their respective frequency of occurrence, numerical contribution, and gravimetric contribution to the diet, plants, *Saduria*, and juvenile salmon comprised approximate equal proportions of the prey spectrum (Figure 4-27).

Chinook Salmon

Saduria entomon were also prominent (88.1%SIRI) in the prey spectrum of the six juvenile chinook salmon examined (Figure 4-28), while chironomids (both larvae and adults), plant material, and plecopterans were minor components of the overall diet.

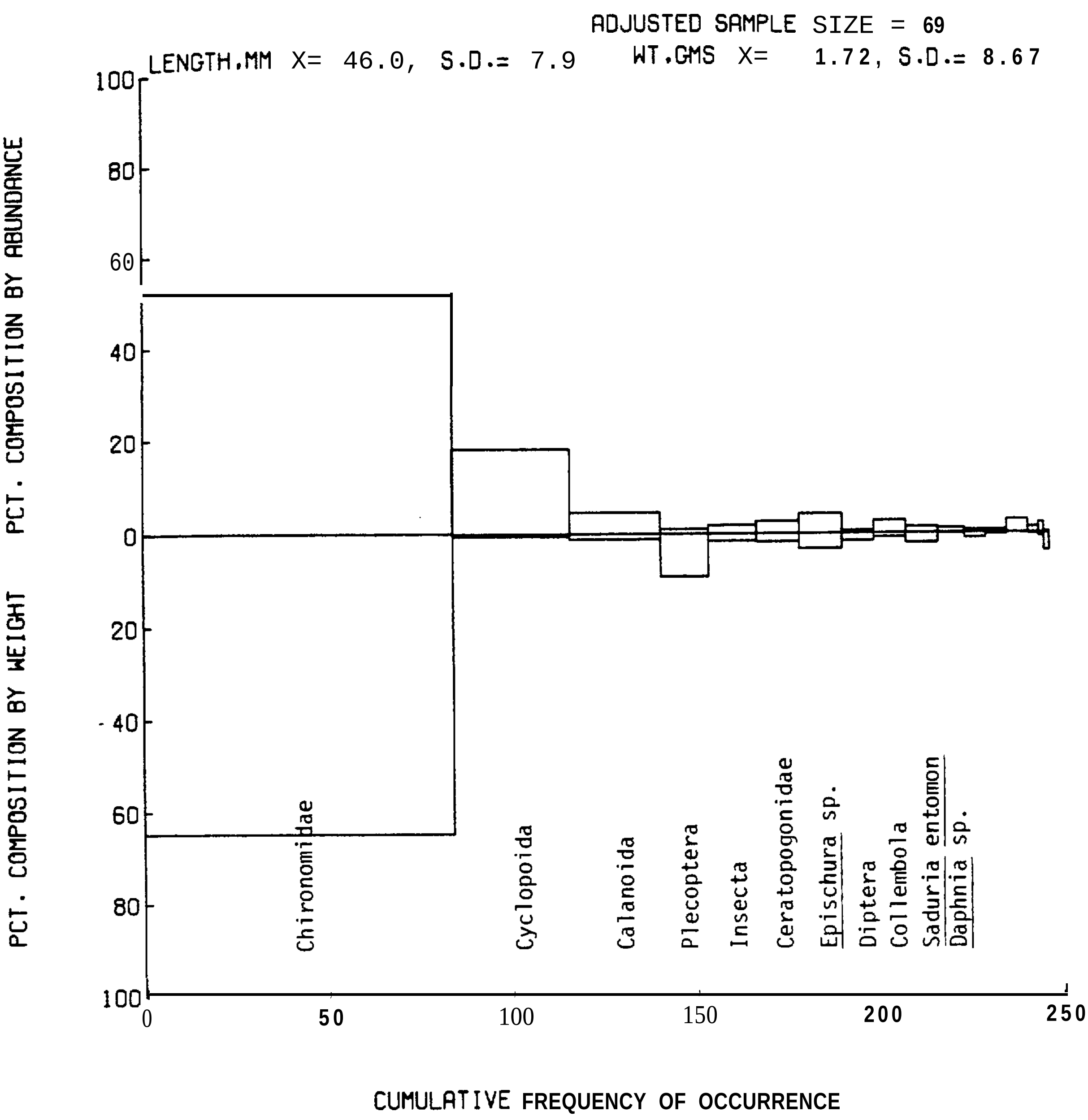


Fig. 4-26 Index of Relative Importance (IRI) prey spectrum of juvenile chum salmon, Oncorhynchus keta, captured in the Yukon River delta, June-September 1985.

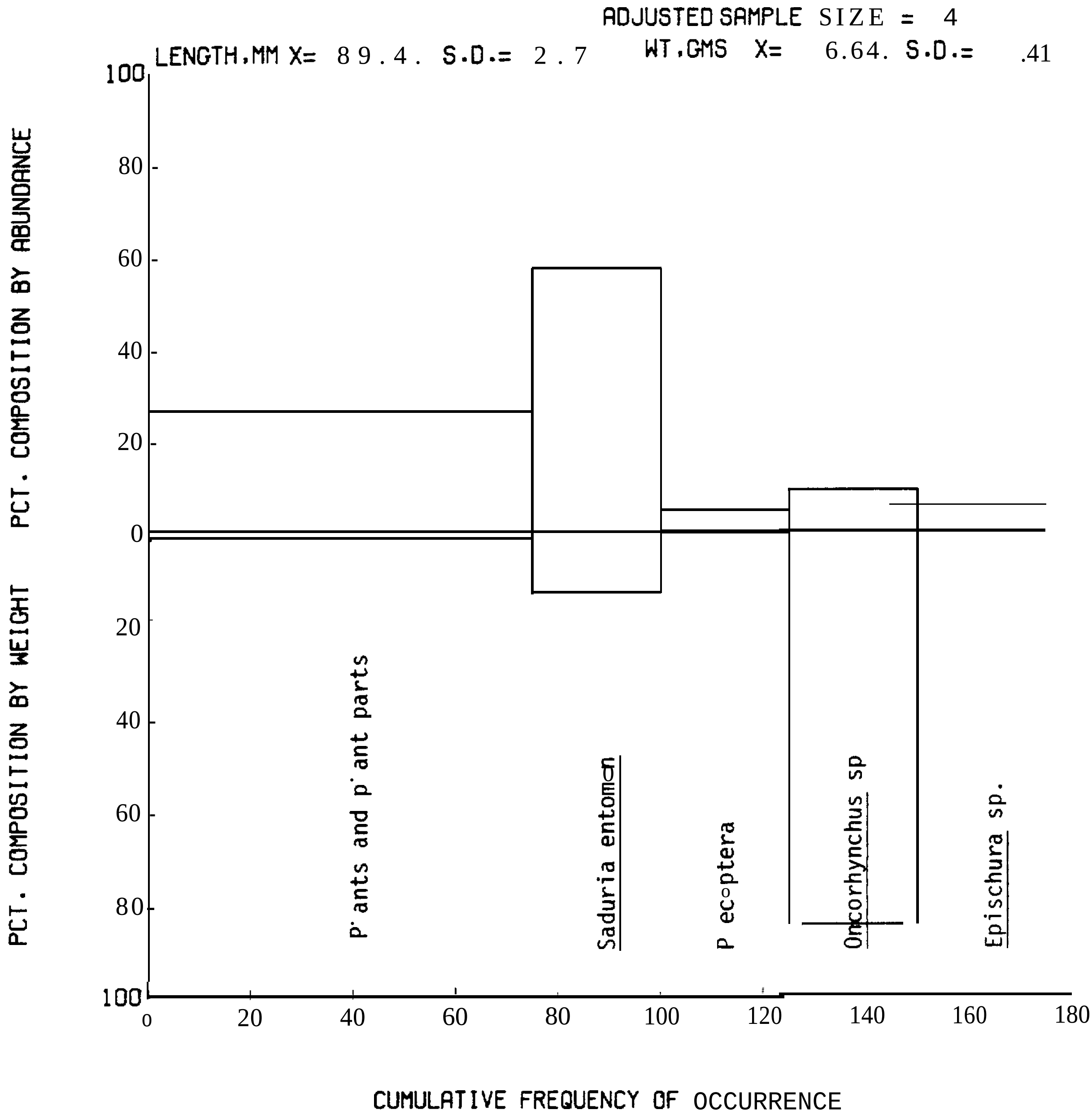


Fig. 4-27 Index of Relative Importance (IRI) prey spectrum of juvenile coho salmon, Oncorhynchus kisutch, captured in the Yukon River delta, June-September 1985.

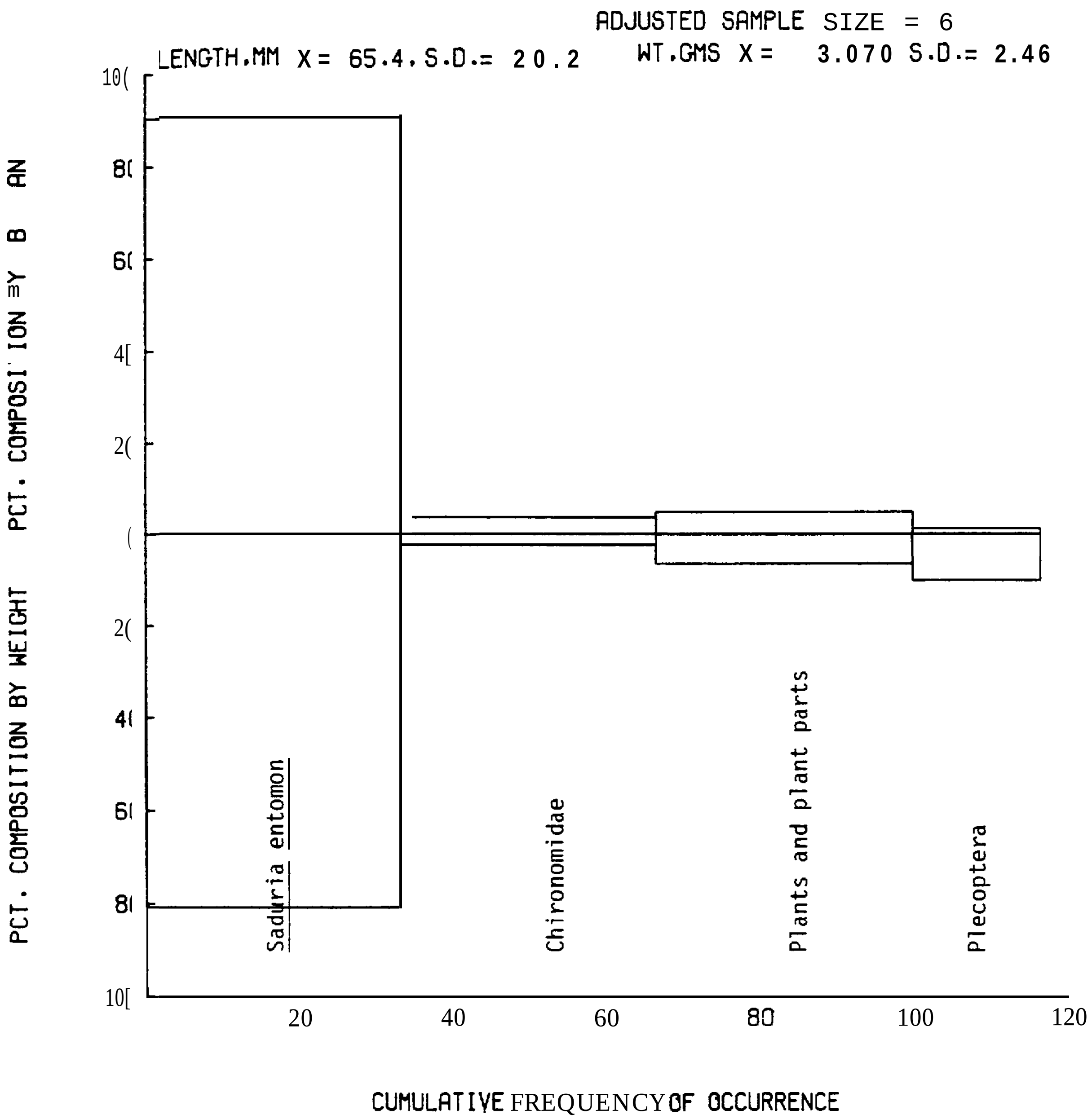


Fig. 4-28 Index of Relative Importance (IRI) prey spectrum of juvenile chinook salmon, Oncorhynchus tshawytscha, captured in the Yukon River delta, June-September 1985.

Sheefish

The prey spectrum of sheefish (Figure 4-29) was dominated by estuarine-marine epibenthos, including mysids (Neomysis sp., 70.7%SIRI) and haustoriid amphipods (14.2%SIRI); freshwater-estuarine chironomids (7.6% SIRI) and cyclopoid (3.5%SIRI) and calanoid copepods (2. 0%SIRI) were the only other prey taxa of significance. In comparison to the other prey spectra from equivalent sample sizes, the overall sheefish diet was intermediate in terms of feeding specificity (e.g., dominance, diversity, and evenness).

Pond Smelt

With a prey spectrum similar in composition to the Bering cisco, the overall diet of pond smelt (Figure 4-30) included predominantly estuarine and marine organisms. Calanoid copepods, which included both the neustonic-surface 'layer marine form, Epilabidocera longipedata, and the archetypical estuarine taxa, Eurytemora sp., accounted for almost 90%SIRI . Harpacticoid (4.6%SIRI) and cyclopoid copepods (1.3%SIRI) and haustoriid amphipods (2.6%SIRI) were also common in the diet (the copepods) or contributed a significant portion of the total prey biomass (the amphipods). Although crangonid shrimp and mysids (Neomysis sp.) each provided between 10% and 13% of the total prey biomass, they were neither common nor numerous in the pond smelt diet. In terms of feeding habits, pond smelt appeared to be one of the more specialized, similar to juvenile chum salmon in the dominance of their prey spectrum by few prey taxa (i.e., high dominance, low diversity).

Boreal Smelt

Boreal smelt also preyed predominantly upon estuarine-marine organisms (Figure 4-3"), although the diet was more diversely (H' = 1.66) distributed among calanoid copepods (51.0%SIRI, including Epilabidocera longipedata , mysids (26.2%SIRI, including Neomysis sp.), and fish (21.9 %SIRI, predominantly larvae and including Clupea harengus pallasi).

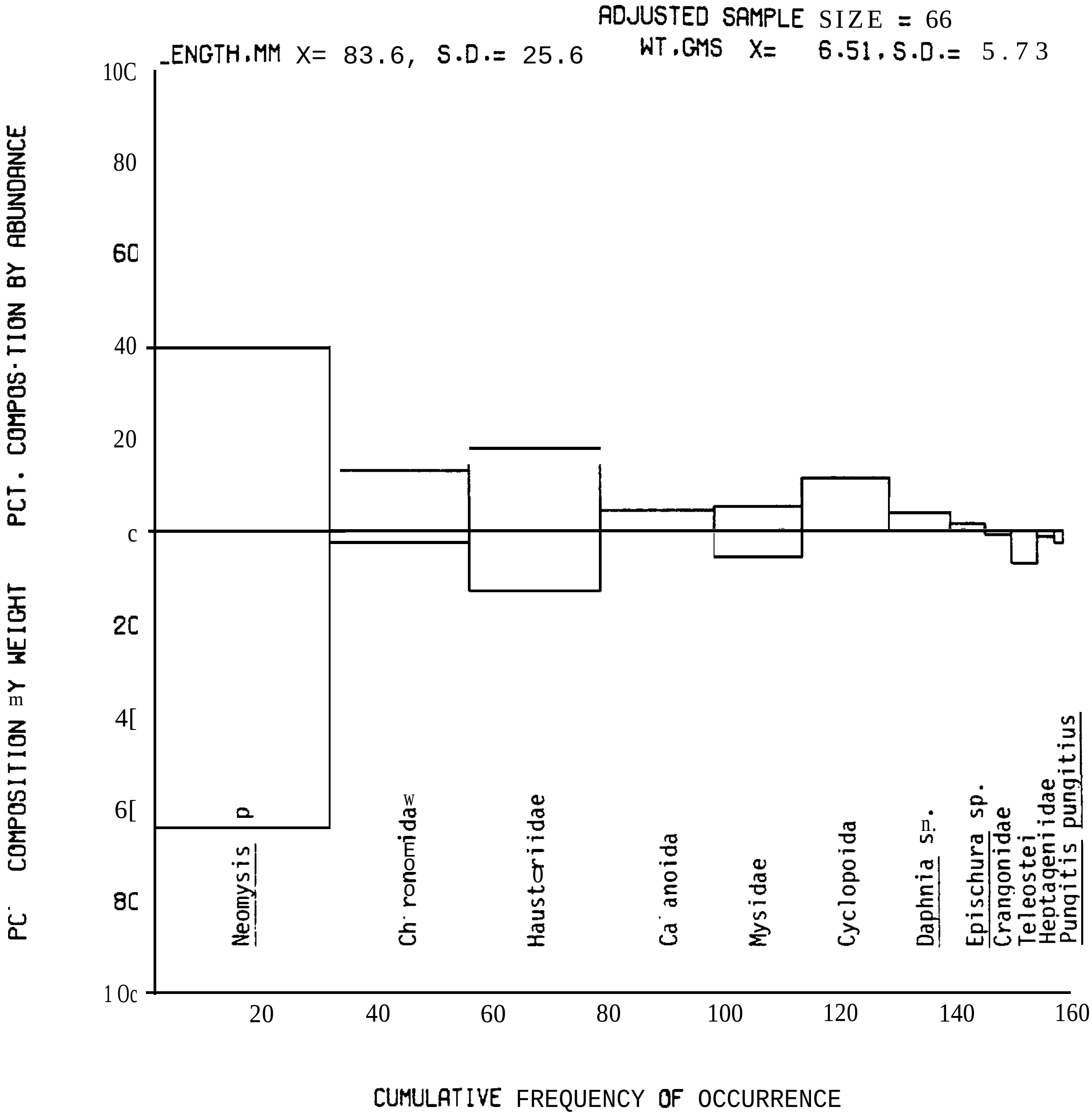


Fig. 4-29 Index of Relative Importance (IRI) prey spectrum of sheefish, *Stenodus leucichthys*, captured in the Yukon River delta, June-September 1985.

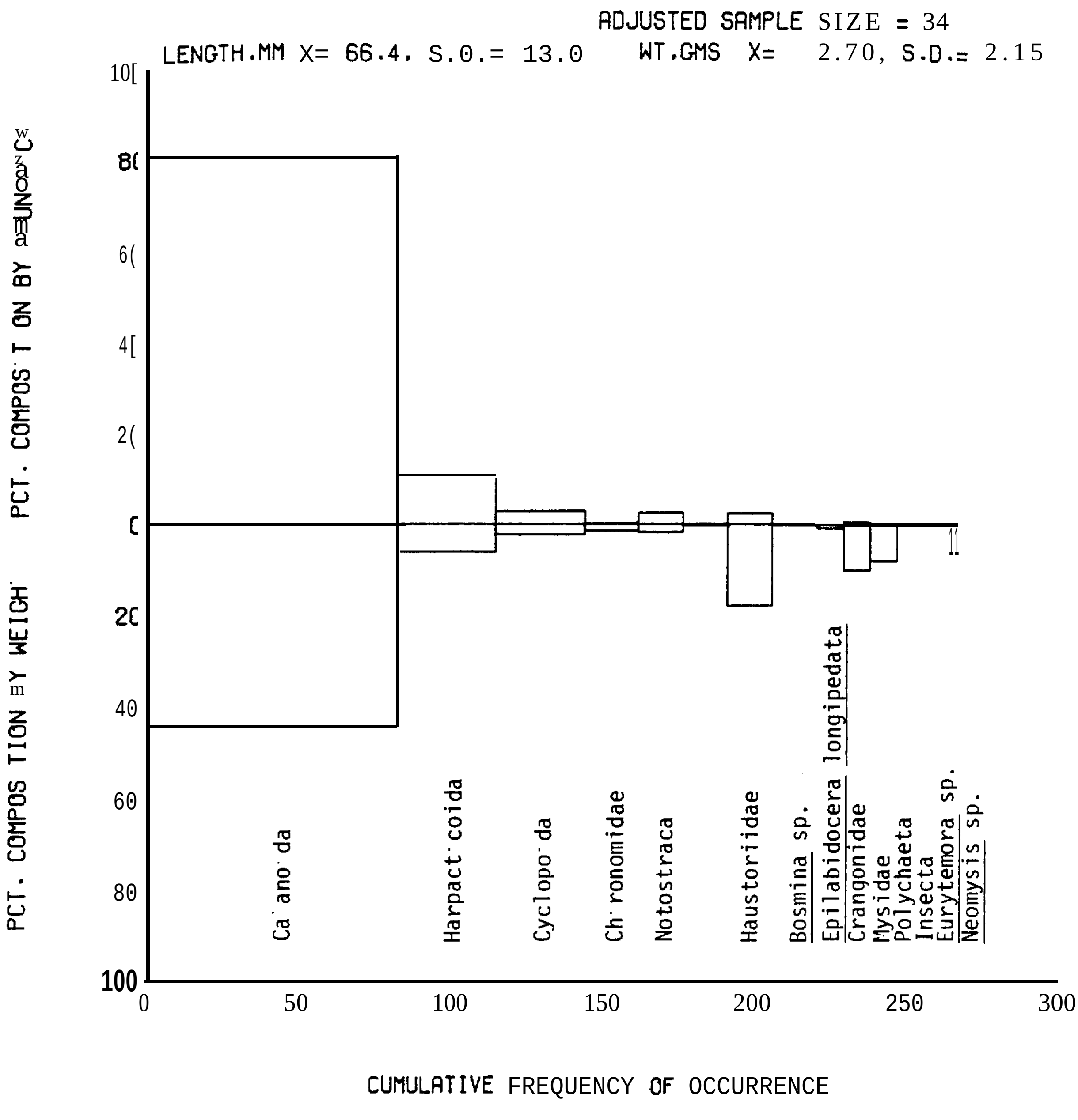


Fig. 4-30 Index of Relative Importance (IRI) prey spectrum of pond smelt, Hypomesus olidus, captured in the Yukon River delta, June-September 1985.

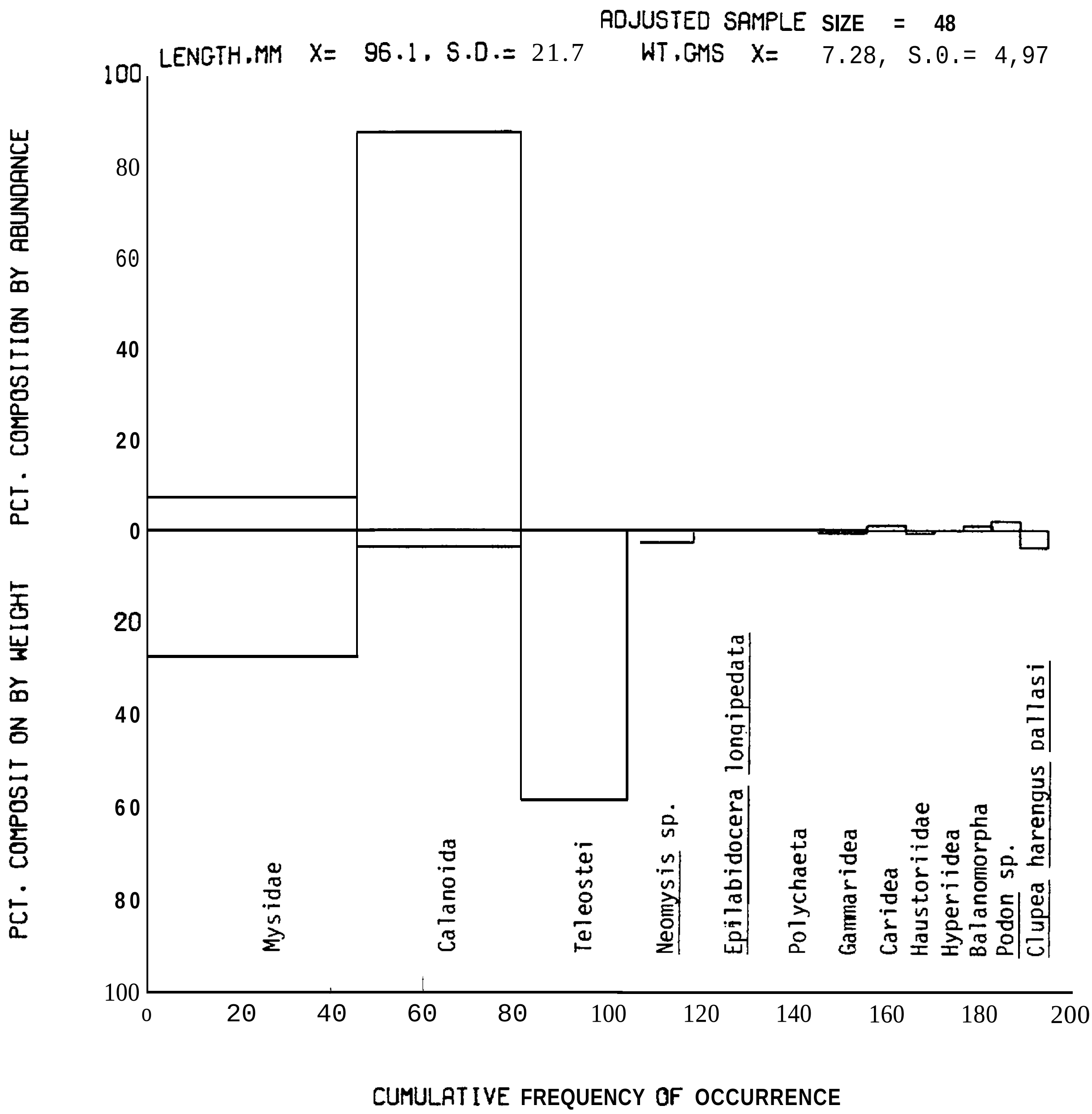


Fig. 4-31 Index of Relative Importance (IRI) prey spectrum of Boreal smelt, *Osmerus eperlanus*, captured in the Yukon River delta, June-September 1985.

Burbot

Probably due to the broad range of sizes (39-141 mm) of burbot sampled, their prey spectrum (Figure 4-32) included a variety of epibenthic, planktonic, and drift prey organisms. Epibenthic estuarine mysids (*Neomysis* sp.) were prevalent (65.4%SIRI) in all aspects. Chironomid larvae (11.1%SIRI), cyclopoid copepods (6 6%SIRI), and ostracods (5.4%SIRI) were also common and abundant in the diet. Approximately half of the total prey biomass, however, was composed of fish (particularly juvenile *Coregonus* sp., but also *Stenodus leucichthys* and *Pungitis pungitius*), but their low occurrence and abundance in the diet resulted in an overall contribution of only 9.4%SIRI.

4.5.3 Diet Variation

Bering Cisco

Purse seine samples from three delta front sites sampled between early August and early September indicated uniform feeding upon calanoid (*Eurytemora* sp.) copepods (Table 4-16); PSI (overlap) among the diet composition in these samples was high, between 72.1% and 93.2%. In contrast, the diet from the one mudflat sample in mid-September was dominated by epibenthic mysids (*Neomysis* sp.), which resulted in essentially no (O to 0.2%) overlap with the other samples.

Least Cisco

Least cisco appeared to prey predominantly upon planktonic copepods and drift insects in most distributary and offshore habitats; mudflat and coastal slough habitats provided a complex of pelagic and epibenthic copepods and gammarid amphipods (Table 4-17). PSI overlap was highest (66.0-79.0%) among the minor active distributary (beach seine) samples and the mid-delta platform (purse seine) sample, and (up to 84.5%) among many of the coastal slough, mudflat, and inner delta platform fyke net samples. In the latter, coastal habitats, epibenthic

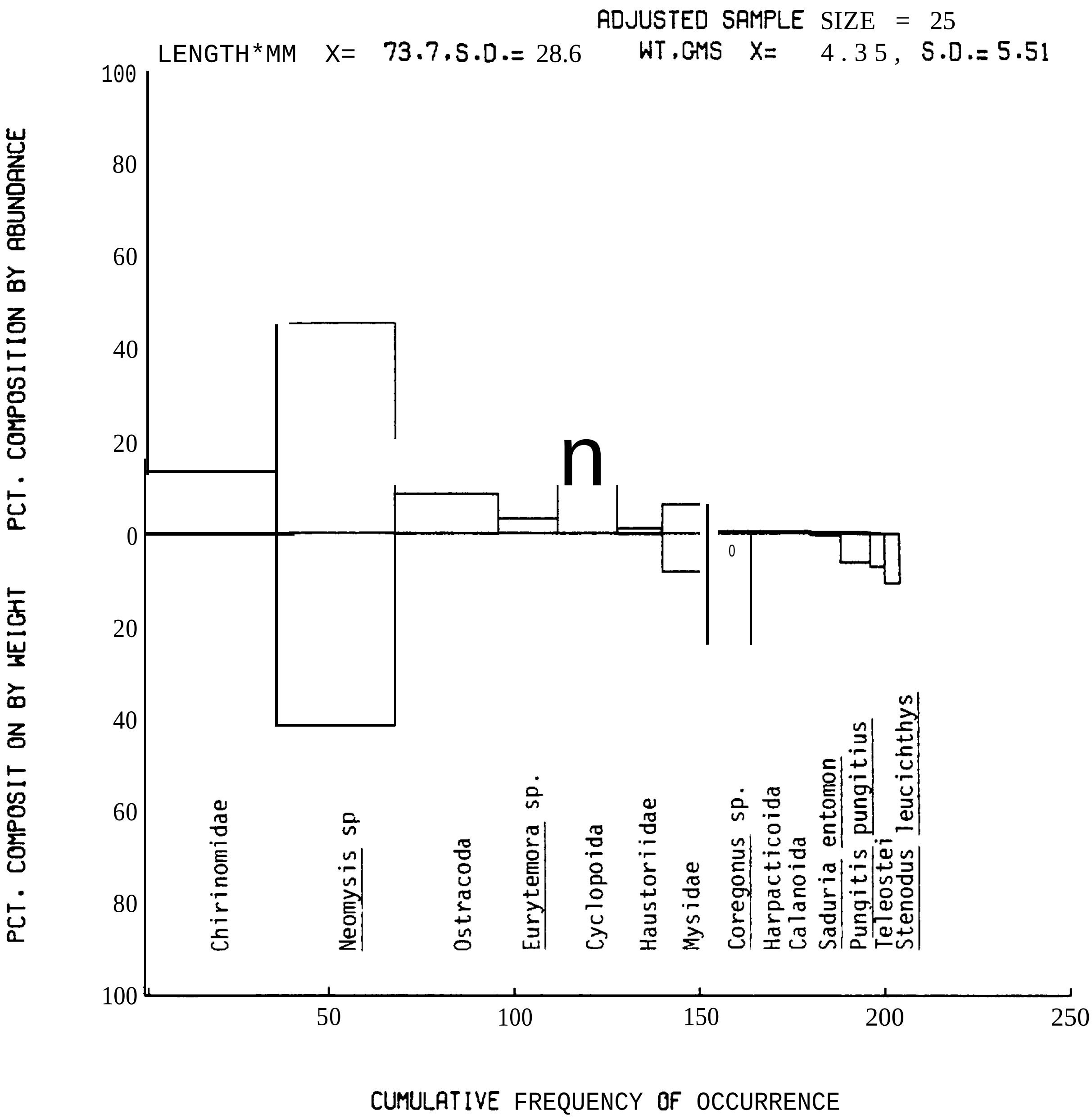


Fig. 4-32 Index of Relative Importance (IRI) prey spectrum of burbot, *Lota lota*, captured in the Yukon River delta, June-September 1985.

TABLE 4-16

DIET COMPOSITION (%SIRI) OF BERING CISCO
OVER SAMPLING HABITAT, STATION, AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Purse Seine			Fyke Net
Habitat:	Delta Front			Mudflat
Station:	1-3	1-1	1-2	4-1
Date:	8/10	8/13	9/10	9/16
n:	5	5	4	5
Bivalvia		+ a/		
Cladocera	6.1	+	1.8	
Calanoida	93.2	99.4	72.0	
Harpacticoida		0.4		
Balanomorpha		+		
Epicaridea		+		
Gammaridea				7.3
Mysidae	0.2			92.7
Caridea	6.6			
Diptera		+	2.3	
Teleostei			23.9	

a/ + = less than 0.1 %SIRI.

TABLE 4-17

DIET COMPOSITION (%SIRI) OF LEAST CISCO
OVER SAMPLING HABITAT,
STATION, AND OATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Hook Seine		Purse Seine				Double Fyke	Single Fyke			Tidal Net			
Habitat:	Minor Active Dist.		Delta Front	Mid-Oelta Plat.	Major Active Dist.		Inner Oel ta Pl at.	Mudfl at			Coastal Slough			
Station:	7-8	7-8	1-2	2-1	6-2	6-2	3-3	4-4	4-4	4-6	5-10	5-10	5-13	5-12
Date:	7/12	8/30	7/26	7/18	8/14	9/13	9/12	7/24	8/27	9/12	7/24	8/27	9/12	9/16
n:	5	5	5	5	1	2	9	2	5	5	5	4	8	5
Araneae		1.2												
Cladocera	0.7					26.3				1.0	0.2		0.4	1.9
Ostracoda														1.1
Calanoida	1.3	0.2	57.1	1.0			20.1	23.6	30.4	95.9	48.1	6.9	61.6	1.4
Harpacti-coida							15.2		25.1	2.5	0.7	93.1	11.7	83.1
Cyclopoida	17.6	1.1	6.7	10.1				23.6			46.0		0.1	
Mysida							5.8		3.4	0.6			14.8	6.2
Gammaridea							58.5	52.9	41.1				11.4	6.2
Penaeidea											5.1			
Insecta		7.0			100		0.2							
Collembola				0.2										
Ephemerop-tera		0.3				73.7								
Psocoptera		1.1												
Thysanoptera	0.7													
Homoptera			34.4											
Aphidoidea		2.8												
Tricoptera				0.4										
Oiptera	63.7	77.2	0.2	77.9			0.2							0.2
Nematocera				1.7										
Brachycera		0.5		8.6										
Drosophil-oidea		0.4												
Muscoidea			1.5											
Hymenopteran	1.0	8.0												
Apocrita	5.6													
Chalcidoidea		0.1												
Proctotru-poidea	9.5		0.2											

harpacticoid copepods and gammarid amphipods and planktonic calanoid and cyclopoid copepods appeared to be relatively "interchangeable" in the diet spectra.

Humpback Whitefish

Diet composition of humpback whitefish was highly variable among sites within habitats, but relatively consistent over time within sites (Table 4-18). The highest consistency occurred in fish captured in coastal sloughs, which preyed on either calanoid (*Eurytemora* sp.) or harpacticoid (*Tachidius* sp.) copepods; highest overlap (PSI = 79.1% to 95.5%) was between samples from two different sampling dates (July-August) at station 5-10, and between these samples and one from mid-September at station 5-11. Overlap among the mudflat samples was marginal except between two samples from station 4-4 taken a week apart in late August (PSI = 92.8%), which had included both gammarid amphipods (haustoriids) as dominant prey items. Samples from minor active distributary station 7-8 and major active distributary station 6-2 in mid-August were also quite similar (PSI = 81.0%) due to the common occurrence of both cyclopoid copepods and dipterans.

Pink Salmon

Prey spectra of juvenile pink salmon displayed uniform utilization of dipterans in minor and major active distributaries and coastal sloughs, as opposed to predation on calanoid copepods (*Epischura* sp.?) in the replicated samples from delta front stations 1-1 and 1-2 (Table 4-19). Prey overlaps (PSI) were between 54.0% and 83.7% among the distributary and slough samples. As might be expected, the two replicated purse seine samples were quite consistent, with 95.4% PSI overlap.

Chum Salmon

In general, the diet compositions from samples of juvenile chum salmon across the delta were uniformly focused upon dipteran (primarily adult) insects (Table 4-20). The occurrence of calanoid and cyclopoid

TABLE 4-18

DIET composition (%SIRI) OF HUMPBACK WHITEFISH
OVER SAMPLING HABITAT, STATION,
AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Hook Seine		Purse Seine		Double Fyke	Single Fyke					Tidal Net					
Habitat:	Minor Active Dist.		Major Active Dist.		Inner Delta Plat.	Mudflat					Coastal Slough					
Station:	7-8	7-2	6-2	6-2	3-3	4-4	4-6	4-4	4-4	4-6	5-10	5-10	5-10	5-13	5-12	5-11
Date:	7/12	8/12	7/21	9/13	9/12	7/24	8/7	8/20	8/27	9/12	7/24	8/27	9/12	9/16	9/16	9/17
n:	5	5	5	1	5	3	4	5	3	4	5	3	5	5	5	5
Rotifera											19.8					
Nematoda											0.6					
Oligochaeta																0.9
Araneae	4.1															
Acarina														0.1		
Crustacea											0.2					
Cladocera		1.9								0.5	10.0			0.2		
Ostracoda					4.3	8.2				2.0	0.2		0.1		27.1	3.6
Calanoida	1.0					6.8	43.7			78.4	6.7	19.0	2.3	63.9		18.8
Harpacticoida		68.1	13.7		62.7	6.8	0.9			19.2	0.6	81.0	92.8	23.5	37.1	76.7
Cyclopoida	33.2	1.9	38.5			78.3					37.1					
Mysida					30.8			0.2	7.4							
Gammaridea					2.3		28.4	99.8	92.6				4.7	10.7	14.1	
Penaeidea											3.8					
Collembola											5.0					
Ephemeroptera				100												
Aphidoidea											0.6					
Coleoptera														0.9		
Tricoptera							27.1									
Diptera	61.7	28.0	47.8								15.5	0.1	0.8			
Brachycera															8.6	

TABLE 4-19

DIET COMPOSITION (%SIRI) OF JUVENILE PINK SALMON
OVER SAMPLING HABITAT,
STATION, AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985

Gear:	Hook Seine		Purse Seine			Single Fyke
Habitat:	Minor Active Dist.		Delta Front		Major Active Dist.	Coastal Slough
Station:	7-3	7-4	1-1	1-2	3	5-6
Date:	6/20	6/22	6/21	6/21	6/20	6/23
n:	8	5	5	3	2	2
Calanoida	1.1	2.3	80.2	76.7	18.4	
Harpacticoida		0.2		4.6	1.1	3.1
Cyclopoida	19.1	34.0			29.3	1.7
Collembola	0.2					1.7
Diptera	79.2	63.5	19.8	18.7	51.2	66.5

TABLE 4-20

DIET COMPOSITION (%SIRI) OF JUVENILE CHUM SALMON
OVER SAMPLING HABITAT, STATION,
AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Hook Seine					Purse Seine		Double Fyke		Purse Seine					Fyke Net
Habitat:	Minor Active Dist.					Delta Front		Mid-Del ta Pl at.		Major Active Distributary					Coastal Slough
Station:	7-3	7-4	7-8	7-8	7-8	1/1	1/2	2-2	2-1	6-1	6-2	6-3	6-1	6-2	4-6
Date:	6/20	6/22	6/28	7/7	8/15	6/21	6/21	6/25	6/30	6/17	6/19	6/25	7/17	7/21	6/23
n:	5	9	5	3	1	3	2	5	10	5	6	5	3	2	5
Acarina									+						
Araneae														3.8	
Crustacea													1.3		
Cladocera			0.3	14.5					0.1						
Ostracoda	2.2												2.2		
Calanoida			9.8	2.5		35.5	54.7	30.8	6.0	0.8		2.5			1.2
Harpacticoida							4.8								14.9
Cyclopoida	1.5		4.6	54.3		2.0		5.6	0.6	0.8	13.9	26.0	3.3		2.3
Vavifera								17.4							33.6
Gammaridea				0.5				18.0							3.6
Insects	1.6	0.8						0.8		1.7	1.4	42.7		3.9	
Collembola		0.9									4.4			2.9	4.5
Heptagenoidea								7.8							
Ephemeroptera											2.3				
Plecoptera			2.1	18.9					0.8	3.1			17.8	7.8	
Psylloidea		0.5													
Coleoptera			9.8									6.4	4.1		
Tricoptera														7.2	
Diptera	92.6	95.6	69.8	9.3	100	47.2	40.6	19.6	92.2	93.6	78.0	22.4	68.0	62.3	39.9
Nematocera	1.4		1.0						+					6.9	
Brachycera									0.2						
Sciomyzoidea			0.4											5.4	
IJrosophiloidea									0.1						
Hymenopteran													3.3		
Tenthredin-oi dea			2.3												
Proctotrup-oi dea	0.7														
Teleostei						15.3									

copepods (the replicated delta front samples from station 1-1, one minor active distributary, and one mid-delta platform sample) and the occurrence of valviferan isopods (Saduria; coastal slough fyke net sample) were the only significant divergences from diet dominated by drift insects.

Coho Salmon

Sample sizes were generally insufficient to make comparisons of juvenile coho salmon diet composition. One sample of two fish was dominated by inorganic debris, one stomach from another sample was filled entirely with juvenile salmon, and another stomach (inner delta platform fyke net sample) was full of the valviferan isopod Saduria entomon.

Chinook Salmon

Only two samples were available for comparison of juvenile chinook salmon diets. One sample (n = 4) from a minor active distributary (station 7-1) beach seine collection was dominated by inorganic matter, with the remainder of the stomach contents being plecopteran and dipteran insects. The other sample (n = 2), from an inner delta platform (station 3-1) fyke net collection, was dominated by Saduria entomon.

Sheefish

Sheefish diets were relatively uniform within, but not between, two habitat groups: (1) minor and active distributaries and mid-delta platform habitats, where the fish fed predominantly upon dipteran insects; and, (2) inner delta platform, mudflat, and coastal slough habitats where epibenthic mysids (Neomysis sp.) and gammarid amphipods (Haustoriid) were the more important prey items (Table 4-21). Except for one sample, an early July beach seine sample in minor active distributary station 7-8, where planktonic copepods were consumed,

TABLE 4-21

DIET COMPOSITION (%SIRI) OF SHEEFISH OVER SAMPLING
HABITAT, STATION, AND DATE IN THE YUKON RIVER DELTA, JUNE-SEPTEMBER 1985.

Gear:	Hook Seine			Purse Seine			Double Fyke		Single Fyke					
Habitat:	Minor Active Dist.			Mid-Delta Plat.	Major Active Dist.		Inner Delta Plat.		Mudflat			Coastal		Slough
Station:	7-8	7-8	7-8	2-1	6-1	6-2	3-5	3-3	4-4	4-1	4-5	5-10	5-10	5-12
Date:	7/7	7/12	8/1	7/18	7/17	7/21	8/19	9/12	7/24	9/16	9/16	7/24	8/28	9/16
n:	5	5	4	5	5	5	5	5	5	5	5	3	4	5
Acarina		1.5												
Cladocera	19.0	14.3		2.3	0.9									
Ostracoda	2.6													
Calanoida	34.3	6.2	1.8	2.6	31.7	3.7						9.6		
Cyclopoida	41.9	17.9	8.1	2.3	0.8									
Mysida							54.9	98.0	0.5	89.4	83.7	90.4	95.0	99.7
Gammaridea							43.1	1.0	99.2	10.6	1.1		5.0	0.3
Caridea								1.0			3.6			
Insects						1.2								
Ephemeroptera			2.3											
Heptagenoidea						9.0	2.0							
Plecoptera		27.3												
Hemiptera		17.0												
Aphidoidea		3.0												
Diptera	2.2	30.6	67.9	82.2	62.9	78.1								
Nematocera					1.6									
Drosophiloidea		2.3			2.2									
Tenthredinoidea				10.6										
Teleostei						8.1			0.3		7.9			
Gasterosteiodei											3.7			

overlap among the first habitat group was always greater than 35-40%, and often greater than 65%. In the case of the second habitat group, only one sample had a majority of the %SIRI contributed by gammarid amphipods; as a result, diet overlap was high (PSI = greater than 80%) in all but a few cases. One of the few long term sample series was also available for the beach seine collections at minor active distributary station 7-8, which indicated a gradual shift from planktonic calanoids and cyclopoids in early July to adult dipteran (drift) insects by early August.

<u>Pond Smelt</u>

Pond smelt diets overlapped extensively among samples from purse seine collections in delta front and major active distributary habitats, but differed somewhat among these samples and fyke net samples from inner delta platform and coastal slough habitats (Table 4-22). Overlap among the samples sampled by the purse seine, which were predominantly fish that had fed upon planktonic calanoid copepods, was very high (PSI = greater than 85%) except in comparison with one sample from the major active distributary station 6-2 (which had fed more on planktonic cyclopoids). Fish from the fyke net samples had also fed on planktonic copepods, but epibenthic mysids and gammarid amphipods were also prominent in their diets, reducing the diet overlap between them (PSI = 19.6%) and among the samples.

<u>Boreal Smelt</u>

The differential utilization of two discrete prey taxa--planktonic calanoid copepods (<u>Epilabidocera longipedata</u> and <u>Eurytemora</u> sp.) and epibenthic mysids (<u>Neomysis</u> sp.)--resulted in generally modest (PSI = 30% to 50%) diet overlap in boreal smelt diet composition (Table 4-23). Significant overlaps were evident, however, among purse seine samples from the delta front (Station 1-2 on 7/26 and station 1-1 on 8-13 = 87.5%) and between delta front and mid-delta platform fyke

TABLE 4-22

DIET COMPOSITION (%SIRI) OF POND SMELT OVER SAMPLING HABITAT, STATION, AND DATE IN THE YUKON RIVER DELTA, JUNE-SEPTEMBER 1985.

Gear:	Purse Seine					Fyke Net	
Habitat:	Delta Front			Major Active Dist.		Inner Delta Platform	Coastal Slough
Station:	1-3	1-1	1-3	6-1	6-2	3-6	5-5
Date:	8/10	8/13	9/4	8/10	8/12	8/4	6/23
n:	5	5	8	2	5	4	5
Polychaeta	0.1		0.3				
Notostraca							4.5
Cladocera	+			2.1	0.4		0.4
Calanoida	87.4	95.7	97.0	85.0	8.4	19.6	46.5
Harpacticoida		0.4	0.3	8.2	0.3		16.4
Cyclopoida				2.6	87.6		1.9
Monstrilloida	0.1						
Balanomorpha		0.6	0.3				
Mysidae	0.1	3.4				80.4	
Gammaridea			2.0				28.4
Caridea	12.4						
Insects					2.8		
Collembola							0.1
Diptera				2.1	0.6		1.7

TABLE 4-23

DIET COMPOSITION (%SIRI) OF BOREAL SMELT
OVER SAMPLING HABITAT, STATION,
AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Purse Seine							Double Fyke	
Habitat:	Delta Front					Mid-Delta Plat.	Delta Front	Inner Delta Platform	
Station:	1-2	1-3	1-1	1-3	1-2	2-3	3-1	3-6	
Date:	7/26	8/10	8/13	9/4	9/10	7/22	7/22	6/23	8/4
n:	5	10	5	5	6	5	5	5	2
Polychaeta		0.4							
Cladocera							1:6		
Ostracoda							+		
Calanoida	1.2	56.9	0.4	4.9	4.7	23.3	76.2		
Harpacticoida		+					+		
Cyclopoida						0.7	0.9		
Balanomorpha							1.0		
Mysidae	87.1	42.7	95.9	38.2	21.0	70.3	19.4		100
Valvifera						1.1	0.7		
Gammaridea	1.2		0.1	9.0	48.0	4.7		4.6	
Hyperiidea							0.7		
Caridea	0.2						1.2		
Brachyura				24.9					
Teleostei	10.5		0.5	2.9	26.3			94.7	
Clupeiformes			3.0	20.0					

net samples (stations 1-1 & 2-3 on 6/.23 & 7/22, respectively) and delta front purse seine samples (station 1-3,8/10 and station 1-1 ,8/13, respectively).

Burbot

The rather eclectic foraging behavior, as well as the broad size range, of burbot resulted in rather minimal overlap among the various stomach samples (Table 4-24). In actuality, the only major overlap (PSI = 98.8%) occurred between samples originating from fyke net collections in two different habitats (coastal slough station 5-13, 8/8:inner delta platform station 3-5) due to the mutual dominance of juvenile mysids in the diet. Otherwise, burbot displayed opportunistic foraging upon planktonic copepods, epibenthic mysids, amphipods, and isopods, drift insects, and fishes.

4.6 POTENTIAL IMPACTS OF OIL AND GAS DEVELOPMENT

4.6.1 Indices of Habitat Utilization and Species Importance

Monthly duration of occurrence values and species abundance by month are reported in Tables 4-25 and 4-26. Chum salmon utilized the Yukon Delta during the entire sampling period, appearing in the highest abundance in June. The other salmon species occurred predominantly early in the season in all habitats except the tidal sloughs and mudflat. Sheefish, ciscoes, and whitefish occurred in riverine habitats all season and moved into offshore locations in July. Sheefish began to move back inshore beginning in August while ciscoes remained offshore for the duration of the sampling season. Whitefish were never found as far offshore as ciscoes and sheefish. Northern pike and burbot utilized predominantly the inshore' and coastal habitats, saffron cod were found in all locations but riverine habitats and herring occurred only on the delta front. Blackfish were found in the minor active distributaries, lakes, and inactive channels. Of these habitats, only the minor active distributaries were sampled

TABLE 4-24

DIET COMPOSITION (%SIRI) OF BURBOT
OVER SAMPLING HABITAT, STATION,
AND DATE IN THE YUKON RIVER DELTA,
JUNE-SEPTEMBER 1985.

Gear:	Hook Seine		Purse Seine	Double Fyke	Single Fyke	
Habitat:	Minor Active Dist.		Major Active Dist.	Inner Delta Plat.	Coastal Slough	
Station:	7-8	7-2	6-2	3-5	5-10	5-13
Date:	8/1	8/3	9/13	8/19	7/24	8/8
n:	3	5	3	5	4	5
Ostracoda	14.5	39.1	5.6			
Calanoida	0.6	21.4		0.1		
Harpacticoida		0.7				0.1
Cyclopoida	12.6	14.6				
Mysidae				98.6	4.2	99.3
Valvifera		5.1			2.3	
Gammaridea		6.6		0.2		0.6
Caridea				0.1		
Collembola		0.7				
Ephemeroptera			47.1			
Diptera	72.4	11.9	47.3			
Teleostei					5.6	
Salmoniformes					82.8	
Gasterosteoidea				1.1	5.1	

TABLE 4-25

MONTHLY DURATION OF OCCURRENCE VALUES
BY SPECIES AND HABITAT

Species	Habitat	June	July	Aug.	Sept.
Chum Salmon	Delta front	1.0	1.0	1.0	0.5
	Mid delta platform	1.0	1.0	1.0	0.5
	Inner delta platform	1.0	1.0	1.0	0.5
	Mudflat	1.0	1.0	0.0	0.0
	Tidal Slough	1.0	1.0	0.5	0.0
	Major active distributary	1.0	1.0	1.0	0.5
	Minor active distributary	1.0	1.0	1.0	0.5
Chinook Salmon	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	1.0	1.0	0.0	0.0
	Inner delta platform	1.0	1.0	0.0	0.0
	Mudflat	0.0	0.0	0.5	0.0
	Tidal Slough	0.0	0.0	1.0	0.0
	Major active distributary	1.0	1.0	0.0	0.0
	Minor active distributary	1.0	1.0	0.0	0.0
Coho Salmon	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.0	0.0	0.0	0.0
	Inner delta platform	0.0	0.0	0.0	0.0
	Mudflat	0.0	0.0	0.0	0.0
	Tidal Slough	0.0	0.0	0.0	0.0
	Major active distributary	0.0	0.0	0.5	0.0
	Minor active distributary	0.0	0.0	0.0	0.0

TABLE 4-25 (Continued)

MONTHLY DURATION OF OCCURRENCE VALUES
BY SPECIES AND HABITAT

Species	Habitat	June	July	Aug.	Sept.
		Month			
Pink Salmon	Delta front	1.0	1.0	0.0	0.0
	Mid delta platform	1.0	1.0	0.0	0.0
	Inner delta platform	1.0	1.0	0.0	0.0
	Mudflat	0.0	0.0	0.0	0.0
	Tidal Slough	1.0	0.0	0.0	0.0
	Major active distributary	1.0	1.0	0.0	0.0
	Minor active distributary	1.0	1.0	0.25	0.6
Sheefish	Delta front	0.0	0.4	0.0	0.0
	Mid delta platform	0.0	0.8	1.0	0.0
	Inner delta platform	0.0	0.6	1.0	1.0
	Mudflat	0.0	1.0	1.0	1.0
	Tidal Slough	1.0	1.0	1.0	1.0
	Major active distributary	1.0	1.0	1.0	1.0
	Minor active distributary	1.0	1.0	1.0	1.0
Ciscoes	Delta front	0.0	0.3	0.75	0.67
	Mid delta platform	0.0	0.2	0.5	1.0
	Inner delta platform	1.0	1.0	1.0	1.0
	Mudflat	1.0	1.0	1.0	1.0
	Tidal Slough	1.0	1.0	1.0	1.0
	Major active distributary	1.0	1.0	1.0	1.0
	Minor active distributary	1.0	1.0	1.0	1.0

TABLE 4-25 (Continued)

MONTHLY DURATION OF OCCURRENCE VALUES
BY SPECIES AND HABITAT

Species	Habitat	Month			
		June	July	Aug.	Sept.
Whitefish	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.0	0.0	1.0	0.0
	Inner delta platform	1.0	1.0	1.0	1.0
	Mudflat	1.0	1.0	1.0	1.0
	Tidal Slough	1.0	1.0	1.0	1.0
	Major active distributary	1.0	1.0	1.0	1.0
	Minor active distributary	1.0	1.0	0.5	1.0
Northern Pike	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.0	0.0	0.0	0.0
	Inner delta platform	0.0	0.0	0.0	0.0
	Mudflat	0.0	1.0	0.0	0.0
	Tidal Slough	0.5	1.0	0.5	0.0
	Major active distributary	1.0	1.0	1.0	1.0
	Minor active distributary	1.0	1.0	1.0	1.0
Burbot	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.0	0.0	0.0	0.0
	Inner delta platform	0.0	0.0	1.0	1.0
	Mudflat	0.0	0.0	0.75	0.33
	Tidal Slough	1.0	1.0	1.0	1.0
	Major active distributary	1.0	0.6	1.0	1.0
	Minor active distributary	1.0	1.0	1.0	1.0

TABLE 4-25 (Continued)

MONTHLY DURATION OF OCCURRENCE VALUES
BY SPECIES AND HABITAT

Species	Habitat	Month			
		June	July	Aug.	Sept.
Saffron Cod	Delta front	0.0	1.0	1.0	1.0
	Mid delta platform	0.0	1.0	1.0	1.0
	Inner delta platform	1.0	1.0	1.0	1.0
	Mudflat	1.0	0.0	1.0	1.0
	Tidal Slough	0.5	1.0	1.0	1.0
	Major active distributary	0.0	0.0	0.0	0.0
	Minor active distributary	0.0	0.0	0.0	0.0
Herring	Delta front	1.0	1.0	1.0	1.0
	Mid delta platform	0.0	0.0	0.0	0.0
	Inner delta platform	0.0	0.0	0.0	0.0
	Mudflat	0.0	0.0	0.0	0.0
	Tidal Slough	0.0	0.0	0.0	0.0
	Major active distributary	0.0	0.0	0.0	0.0
	Minor active distributary	0.0	0.0	0.0	0.0
Blackfish	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.0	0.0	0.0	0.0
	Inner delta platform	0.0	0.0	0.0	0.0
	Mudflat	0.0	0.0	0.0	0.0
	Tidal Slough	0.0	0.0	0.0	0.0
	Major active distributary	0.0	0.0	0.0	0.0
	Minor active distributary	0.5	0.0	0.0	0.0

TABLE 4-25 (Continued)

MONTHLY DURATION OF OCCURRENCE VALUES
BY SPECIES AND HABITAT

Species	Habitat	Month June	July	Aug.	Sept.
Smelt	Delta front	1.0	1.0	1.0	1.0
	Mid delta platform	0.5	1.0	1.0	0.0
	Inner delta platform	1.0	1.0	1.0	1.0
	Mudflat	1.0	0.8	1.0	0.5
	Tidal Slough	1.0	0.0	0.5	0.67
	Major active distributary	1.0	0.0	1.0	1.0
	Minor active distributary	1.0	1.0	1.0	1.0
Starry Flounder	Delta front	0.0	0.0	0.0	0.0
	Mid delta platform	0.5	1.0	0.5	1.0
	Inner delta platform	1.0	1.0	0.5	1.0
	Mudflat	1.0	1.0	1.0	1.0
	Tidal Slough	1.0	1.0	1.0	1.0
	Major active distributary	0.0	0.0	0.0	0.0
	Minor active distributary	1.0	0.4	0.25	0.0

TABLE 4-26

MONTHLY ABUNDANCE VALUES BY SPECIES AND HABITAT

Species	Habitat	Month June	July	Aug.	Sept.
Chum Salmon	Delta front	1	1	1	1
	Mid delta platform	2	1	1	1
	Inner delta platform	3	1	1	1
	Mudflat	1	1	0	0
	Tidal Slough	1	1	1	0
	Major active distributary	3	1	1	1
	Minor active distributary	3	1	1	1
Chinook Salmon	Delta front	0	0	0	0
	Mid delta platform	1	1	0	0
	Inner delta platform	1	1	0	0
	Mudflat	0	0	1	0
	Tidal Slough	0	0	1	0
	Major active distributary	1	1	0	0
	Minor active distributary	1	1	0	0
Coho Salmon	Delta front	0	0	0	0
	Mid delta platform	0	0	0	0
	Inner delta platform	0	0	0	0
	Mudflat	0	0	0	0
	Tidal Slough	0	0	0	0
	Major active distributary	0	0	1	0
	Minor active distributary	0	0	0	0

TABLE 4-26 (Continued)

MONTHLY ABUNDANCE VALUES BY SPECIES AND HABITAT

Species	Habitat	Month			
		June	July	Aug.	Sept.
Pink Salmon	Delta front	1	1	0	0
	Mid delta platform	1	1	0	0
	Inner delta platform	1	1	0	0
	Mudflat	0	0	0	0
	Tidal Slough	1	0	0	0
	Major active distributary	1	1	0	0
	Minor active distributary	1	1	1	1
Sheefish	Delta front	0	1	0	0
	Mid delta platform	0	1	1	0
	Inner delta platform	0	1	2	2
	Mudflat	0	3	2	2
	Tidal Slough	2	3	1	2
	Major active distributary	1	2	1	1
	Minor active distributary	1	2	1	1
Ciscoes	Delta front	0	2	1	1
	Mid delta platform	0	3	1	1
	inner delta platform	1	1	1	1
	Mudflat	1	2	3	3
	Tidal Slough	3	3	2	1
	Major active distributary	1	2	1	1
	Minor active distributary	1	2	1	1

TABLE 4-26 (Continued)

MONTHLY ABUNDANCE VALUES BY SPECIES AND HABITAT

Species	Habitat	Month			
		June	July	Aug.	Sept.
Whitefish	Delta front	0	0	0	0
	Mid delta platform	0	0	1	0
	Inner delta platform	1	1	1	1
	Mudflat	2	3	3	1
	Tidal Slough	3	3	3	2
	Major active distributary	1	2	3	1
	Minor active distributary	1	2	1	1
Northern Pike	Delta front	0	0	0	0
	Mid delta platform	0	0	0	0
	Inner delta platform	0	0	0	0
	Mudflat	0	1	0	0
	Tidal Slough	1	1	1	0
	Major active distributary	1	1	1	1
	Minor active distributary	1	1	1	1
Burbot	Delta front	0	0	0	0
	Mid delta platform	0	0	0	0
	Inner delta platform	0	0	2	1
	Mudflat	0	0	1	1
	Tidal Slough	1	1	1	1
	Major active distributary	1	1	1	1
	Minor active distributary	1	2	1	1

TABLE 4-26 (Continued)

MONTHLY ABUNDANCE VALUES BY SPECIES
AND HABITAT

Species	Habitat	Month June	July	Aug.	Sept.
Saffron Cod	Delta front	0	1	3	3
	Mid delta platform	0	1	1	1
	Inner delta platform	1	1	2	3
	Mudflat	1	0	1	2
	Tidal Slough	1	0	1	2
	Major active distributary	0	0	0	0
	Minor active distributary	0	0	0	0
Herring	Delta front	1	2	1	1
	Mid delta platform	0	0	0	0
	Inner delta platform	0	0	0	0
	Mudflat	0	0	0	0
	Tidal Slough	0	0	0	0
	Major active distributary	0	0	0	0
	Minor active distributary	0	0	0	0
Blackfish	Delta front	0	0	0	0
	Mid delta platform	0	0	0	0
	inner delta platform	0	0	0	0
	Mudflat	0	0	0	0
	Tidal Slough	0	0	0	0
	Major active distributary	0	0	0	0
	Minor active distributary	1	0	0	0

TABLE 4-26 (Continued)

MONTHLY ABUNDANCE VALUES BY SPECIES AND HABITAT

Species	Habitat	Month			
		June	July	Aug.	Sept.
Smelt	Delta front	3	3	3	1
	Mid delta platform	1	0	1	3
	Inner delta platform	3	1	2	1
	Mudflat	1	1	1	1
	Tidal Slough	1	1	2	0
	Major active distributary	1	1	1	0
	Minor active distributary	3	2	1	1
Starry Flounder	Delta front	0	0	0	0
	Mid delta platform	1	1	1	1
	Inner delta platform	1	1	1	1
	Mudflat	1	2	1	1
	Tidal Slough	1	1	1	1
	Major active distributary	0	0	0	0
	Minor active distributary	1	1	1	0

frequently enough to determine relative species abundance and occurrence. For a detailed description of distribution and abundance, see Sections 4.3 and 5.2.

The contribution of each species to the local commercial and subsistence fisheries (Table 4-27) was determined relative to the catch of chum which represented the species which contributed the most to the total local catches. The catch of chum overwhelmed the catches of most other species. Chinook salmon had the second largest catch (approximately 0.143 as high as chum) and the catch of coho salmon was third (0.028 the size of the chum catch). The catch of all other species are less than one hundredth the size of the chum catch.

4.6.2 Indices of Species Sensitivity to Oil

The exposure of fish to spilled petroleum and its water soluble aromatic hydrocarbons could produce a variety of lethal and sub-lethal effects. The acute effects of hydrocarbon exposure have been extensively studied. However, interpretation and comparison of these results are often difficult due to the general lack of standardization of methods, the frequent lack of monitoring of hydrocarbon concentrations during the bioassay, (Patten 1977) and the differing levels of highly toxic aromatic hydrocarbons found in oil from different sources. Prudhoe Bay crude contains approximately 25% aromatic hydrocarbons which is quite high (Nelson-Smith, 1982). A further complication is the interpretation of laboratory studies in terms of responses that would occur under natural environmental conditions. Reviews of test results including discussions of comparative methods can be found in Rice (1976), Craddock (1977), Patten (1977), NAS (1975, 1983) and Bax (1985).

Possible sub-lethal responses include a variety of physiological and behavioral changes, many of which can lead to the death of the animal or impact the population levels of a species over a long period. Possible physiological changes include changes in the fecundity, survival, growth rates, and formation of metabolizes (Patten 1977).

TABLE 4-27

RELATIVE CONTRIBUTION OF EACH SPECIES TO THE LOCAL COMMERCIAL AND SUBSISTENCE FISHERIES ESTIMATED FROM 10-YEAR AVERAGE CATCH OF SALTWATER AND ANADROMOUS SPECIES AND 5-YEAR AVERAGE CATCH OF FRESHWATER SPECIES

Species	Relative Contribution
Chum salmon	1.000
Chinook salmon	0.143
Coho salmon	0.028
Pink salmon	0.001
Sheefish	0.002
Ciscoes	0.002
Whitefish	0.002
Northern pike	0.001[a]
Burbot	0.001[a]
Saffron cod	0.001[a]
Herring	0.002
Blackfish	0.006[a]
Smelt	0.000
Starry Flounder	0.000

a/ Estimated from household harvest rates reported by Wolfe (1981).

Most of these physiological responses are poorly studied and understood. Changes in growth and survival of eggs and larvae of a number of species including herring (Struhsaker et al. 1974; Kuhnhold 1969; Rice et al. 1975; Moles et a' . 1979; Smith and Cameron 1979), flounder (Sprague and Carson 1970; Vaughn 1973), cod (Kuhnhold 1969) and pink salmon (Rice et al. 1975) have been studied. Generally, pelagic eggs and larvae have been ound to be highly susceptible to damage as a result of contact with oil and oil extracts.

Possible behavioral responses to exposure to hydrocarbons include avoidance reactions which have been demonstrated in several species (Rice 1973; Weber et al. 1981; Maynard and Weber 1981; Anonymous 1978), Cough response (Rice et al. 1977) and interference with migration, changes in locomotor and activity patterns, and reduced feeding (Patten 1977). Exposure of a habitat to oil may also have substantial impacts on fish growth and reproduction through changes in availability of prey items and other perturbations of the aquatic ecology (Simenstadt et al. 1979; Budosh and Atlas 1977; Moore and Dwyer 1973; Shaw et al. 1981; Anderson et al. 1974).

Possible responses to exposure to oil which were considered in assigning susceptibility levels include the results of acute toxicity tests, impact on food availability, avoidance reactions, survival of eggs and larvae, and the ability of a species to relocate to other less affected habitats. Little, if any, information was available on other factors which may affect the impact of exposure to oil.

Description of factors considered for each species in determining potential vulnerability levels follow and are summarized in Table 4-28.

Salmon

Many experiments designed to measure the acute toxic effects of exposure to oil on various salmon species have been reported (Rice et al. 1975a; Rice et al. 1975b; Rice et al. 1976; Rice et al. 1977; Moles et al. 1979; Moles 1980; Moles et al. 1981; Moles et al. 1983; Cardwell

TABLE 4-28

SUSCEPTIBILITY LEVELS OF SPECIES
FOUND IN THE YUKON RIVER DELTA

Species	Susceptibility Rating	Numerical Rating	Type of Potential Impact
Chum Salmon	Medium	3	Reduction of food availability Possible interference in migration patterns
Chinook Salmon	Medi urn	3	Reduction of food availability Possible interference in migration patterns
Coho Salmon	Medi urn	3	Reduction of food availability Possible interference in migration patterns
Pink Salmon	High	4	High sensitivity to aromatics Reduction of food availability Possible interference in migration patterns
Whitefish, Sheefish & Ciscoes	Low	2	Reduction in food availability Ability to relocate to lesser impacted habitats
Herring	Negligible	1	Negligible
Saffron Cod	Medium	3	Toxic to eggs and larvae Reduction in food availability
Starry Flounder	Medium	3	Toxic to eggs and larvae Reduction in food availability
Smelt	Low	2	Interference in migration patterns
Northern Pike	Low	2	Highly tolerant eggs and 1 arvae
Blackfish	Low	2	Demersal habit Reduction in food availability
Burbot	Low	2	Reduction in food availability

1973; Wolf and Strand 1973; Bean et al. 1974; Rice 1973; Morrow 1973), however, the results of few of these experiments are comparable due to variation in methods and experimental design (including differences in salinity of test water, differences in sources of oil, differences in methods used to prepare the oil and water mixture, and differences in methods of measuring concentrations of oil in solution). Different salmon species were seldom tested using similar methods. Moles et al. (1979) tested three species of salmon fry in freshwater and reported '6 'r "50 values of 4.0 ppm, 3.6 ppm, and 3.7 ppm for sockeye, chinook, and coho, respectively. In a later study using similar methods, Moles et al. (1983) reported an LC_{50} values for pink salmon of 1.2 ppm. Cardwell tested chinook salmon in a freshwater and oil emulsion and chum and pink salmon in a saltwater emulsion. The 96 hr LC_{50} calculated in that experiment was reported to be 0.349 ml/1 for chinook, 0.312 ml/1 for chum, and 0.184 ml/1 for pink salmon. The results of these studies suggest that coho, chinook and sockeye experience similar reactions to oil exposure and that pink are more susceptible to adverse affects of oil than are the other salmon species.

Moles et al. (1979) reported that outmigrants of the salmonid species tested were more sensitive to exposure to benzene or Prudhoe Bay crude oil in saltwater as outmigrants in freshwater, which concurs with results found by Rice et al. (1975). This suggests that the point of transition from fresh to saltwater environments may be a critical point for salmonids exposed to oil contamination.

Upon entry into saltwater salmonid smelts begin to switch their prey from a diet of freshwater dipterans to a diet of neritic zooplankton such as harpacticoid copepods and gammarid amphipods (Simenstad et al. 1979). Information regarding toxicity of oil to harpacticoids is limited. However, studies of toxicity to gammarid amphipods indicate that oil spills in the Arctic may cause large scale mortality of these species (Busdosh and Atlas 1977; Percy and Mullen 1975), thereby reducing the quantity of available food to these outmigrants.

The avoidance of oil and oil extracts by juvenile salmonids is not well documented, but studies indicate that some level of avoidance may be expected. Pink salmon fry were found to avoid the water soluble fraction of Prudhoe Bay crude oil in laboratory experiments using both salt and freshwater (Rice 1973). The avoidance reaction reported was greater in fry adapted to seawater, and appeared to increase with age. The avoidance response to dissolved hydrocarbons has also been reported by Maynard and Weber (1981) and Shaw et al. (1981) in laboratory tests. The threshold concentration at which avoidance reactions were demonstrated was highly variable, ranging from497 ppm for pink salmon in freshwater in early summer to 1.6 ppm for pink salmon in saltwater in late summer. All these tests were conducted in laboratory situations. The avoidance reactions in a natural situation have not been documented, but these studies suggest that some level of avoidance to oil extracts can be expected in juvenile salmonids. This may help to reduce the amount of dissolved hydrocarbons encountered by outmigrants, but may also result in disruption of migration paths.

Given the above factors, vulnerability to the toxic effects of oil for all salmon species except pinks was rated medium relative to other fish species found on the Yukon delta. Due to the extreme sensitivity to aromatic hydrocarbons demonstrated in pink salmon, this species has been given a relative susceptibility rating of high.

The ratings given the salmon species consider only the lethal and sublethal effects of exposure to petroleum hydrocarbons and speculation on how the exposure may affect their food supply. Factors which were not considered due to the lack of available information include the vertical distribution of the species in the water column, size of the fish, age of the fish, and detailed information regarding diet and dependence on specific food items.

Whitefish. Sheefish, and Ciscoes

The effects of exposure to oil or oil extracts on whitefish, sheefish, and ciscoes has largely been ignored despite their abundance in arctic and subarctic habitats and their importance to subsistence fisheries. Because of similarities in life history and phylogeny, the vulnerability of these species to the effects of oil is probably similar to that found in salmon fry, arctic char, or dolly varden. Moles et al. (1979) found the median tolerance limits (TLm's) to the water soluble portion of Prudhoe Bay crude oil to range from 1.25 mg/L (dolly varden) to 2.17 mg/l (arctic char) with the salmon species and arctic grayling tolerance limits falling somewhere between. Where coregonids fall in this range (or outside of it) is unknown. It is possible, given the wide range of those species tested, that any or all of the coregonids may be highly susceptible or, conversely, relatively tolerant to exposure to hydrocarbons. It i s assumed here that the effect of direct exposure to these species is similar to that of chum, chinook, or coho.

Sheefish, ciscoes, and whitefish all spawn predominantly upriver from the delta, removing any danger of exposure to spawning beds. The greatest potential sub-lethal effect which these species may encounter is the probable reduction in food availability, particularly on the tidal flats and delta platform. Concentrations of prey items may also be reduced within river channels, but this reduction is expected to be less severe due to extensive flushing of the river. Most adult forms of fish have been shown to exhibit some sort of avoidance reaction to concentrations of hydrocarbons. Because these coregonid species are not dependent on migration routes to complete their life history, it is possible that they will move to less impacted areas, avoiding lethal contact. Therefore these species have been given a relative susceptibility rating of low.

Herring

Adult herring were captured only on the delta front. They apparently do not spawn along the delta, nor does the delta appear to be used as a nursery ground. Therefore, the fact the herring eggs and larval have been found to be extremely sens· tive to contact with hydrocarbons (Smith and Cameron 1979; Vaughn 1973; Rice et al. 1975) has no bearing on the presence of the species n the study area. Herring in the Yukon Delta area were given a susceptibility rating of negligible.

Saffron Cod

Saffron cod is a demersal species which spawns in the shallows, and has pelagic eggs and larvae. The eggs of cod species have been found to be less sensitive to exposure to hydrocarbons than herring eggs, but the larvae are very sensitive to exposure, the actual results varying with the origin of the crude oil used in testing (Kunhold 1969; Kunhold 1979). Given this sensitivity in combination with a probable reduction in available food, a serious impact to Yukon delta stocks is possible for one or more year classes depending on the duration of toxic levels of hydrocarbons in the area. Saffron cod are, however, quite ubiquitous in the subarctic and numbers in the area would probably recover rapidly; therefore, cod were given a susceptibility rating of medium.

Starry Flounder

Starry Flounder also have pelagic eggs and larvae. No tests of acute toxicity of starry flounder have been conducted, however the rates of mortality and disformity of larvae due to exposure to a variety of types of oil have been studied (Craddock 1977). The result of these studies are variable, but most suggest that low levels of oil may be quite toxic to the eggs and larvae. The effects of oil on this species were considered to be similar to the effects on arctic cod and the species was given a susceptibility rating of medium.

Smelt

No studies are available on the toxic effects of oil on smelt. Assuming this species exhibits some sort of avoidance reaction, the freshwater runs may encounter some interference in migration routes. Due to lack of information, the susceptibility was assigned a low level.

Northern Pike

Pike were found distributed throughout the inland channels of the Yukon delta, particularly in backwater channels and lakes where currents are low. No information was found pertaining to the toxic effects of contact with oil and oil extracts on adult northern pike. However, the eggs and larvae were found to be highly tolerant of exposure (Craddock 1977). For lack of any further information on northern pike, they were assigned a susceptibility level of low.

Blackfish

No literature was found on the vulnerability of blackfish to exposure to oil. The species is a demersal freshwater fish which has evolved an ability to endure stress resulting from the exposure to extreme cold. Because they inhabit the marshes and backwaters of the tidal plane, they would undoubtedly encounter considerable amounts of dissolved extracts in the water and sunken residue on the bottom. The actual impact of the presence on oil is unknown, but is assumed to be low based on their known tolerance of stress stemming from other sources.

Burbot

No information could be found on this species with respect to oil exposure. Given their broad distribution and their tendency to spawn upriver, their susceptibility level was assumed to be low.

4.6.3 Indices of Relative Impact

Indices of relative impact for each habitat were determined monthly and for the entire sampling season (Tables 4-29 and 4-30). The community importance value for chum salmon so overwhelmed the values for other species that the habitat impact indices which included these values were predominantly an index with respect to chum. Therefore, indices were also calculated without consideration to community importance values (Table 4-29 and 4-30). The indices which included the community importance values indicated that the inriver and delta platform habitats were the most vulnerable to the impacts of oil in June, August, September, and for the season as a whole. All habitats were rated nearly equal in July.

Habitat impact ratings calculated without the community importance values were very different. In June and for the entire sampling season, the inner delta platform, tidal sloughs, and minor active distributaries received the highest potential impact ratings. In July, all habitats except the delta front received similar ratings, with the minor active distributions ranking the highest in vulnerability. The inner delta platform, mudflat, and tidal sloughs were rated the most vulnerable in August and September, though the values in September were generally much reduced. September was, overall, the least vulnerable month to the effects of oil, reflecting the reduced numbers of all species in the catches of that month.

TABLE 4-29

RELATIVE IMPACT (SCALE 0 TO 10) OF AN OIL SPILL ON THE FISH COMMUNITY IN HABITATS OF THE YUKON RIVER DELTA DURING SUMMER

Habitat	Month			
	June	July	Aug.	Sept.
Community importance values included:				
Delta front	3.2	3.2	3.2	0.1
Mid delta platform	10.0	3.6	3.2	1.6
Inner delta platform	10.0	3.6	3.2	1.6
Mudflat	3.2	3.2	0.3	0.1
Tidal Slough	3.2	3.2	1.7	0.1
Major active distributary	10.0	3.7	3.2	1.6
Minor active distributary	10.0	3.7	3.2	1.6
Community importance values excluded:				
Delta front	4.4	5.2	6.7	5.1
Mid delta platform	5.7	8.4	4.8	2.7
Inner delta platform	9.2	7.0	9.5	7.8
Mudflat	5.1	8.4	8.3	6.9
Tidal Slough	10.0	8.3	8.3	6.8
Major active distributary	7.0	8.0	6.7	3.0
Minor active distributary	9.8	9.1	6.7	5.6

TABLE 4-30

OVERALL RELATIVE IMPACT (SCALE 0 TO 10) OF AN OIL SPILL ON THE FISH COMMUNITY IN HABITATS OF THE YUKON RIVER DELTA DURING SUMMER (i.e., JUNE-SEPTEMBER)

	Impact Rating	
Habitat	Community Importance Values Included	Community Importance Values Excluded
Community importance values included:		
Delta front	5.2	6.4
Mid delta platform	10.0	6.4
Inner delta platform	10.0	10.0
Mudflat	3.6	8.6
Tidal Slough	4.4	9.7
Major active distributary	10.0	7.4
Minor active distributary	10.0	9.3

5.0 DISCUSSION

5.1 PHYSICAL ENVIRONMENT

5.1.1 Characterization of Habitats Based on Physical Factors - Sumner Discrete Measurements.

Delta Front

The delta front habitat is defined as the depositional area seaward of the delta platform. This zone extends from the edge of the delta platform to the prodelta. The seaward edge of the delta platform is typically located 20 to 30 km offshore and at a depth of approximately 3 m. The delta front meets the prodelta at a distance of 25 to 35 km offshore, where depths average 14 m. Stations sampled in this zone ranged from 6 to 9 m and averaged 7 m in depth.

The delta front was the most variable habitat studied and was the only habitat where truly estuarine conditions were encountered. A high degree of stratification was often evident in both temperature and salinity. Surface waters averaged 12.4°C and 6.5 parts per thousand (ppt) salinity while bottom waters averaged 10.6″C and 13.2 ppt salinity.

Water column salinity stratification generally intensified over the course of the summer survey (Appendix A). In June and July differences in salinity between surface and bottom waters were generally 4 to 7 ppt. By August and September salinity differences between surface and bottom waters were often up to23 pptwith bottom waters ranging from 23 to 26 ppt.

Temperature differences between surface and bottom waters tended to be most extreme in June and July when 4 to 5 degree variations were common. Surface waters ranged from 10 to 15°C and bottom temperatures varied between 4 to 15°C. By August and September temperatures were typically uniform throughout. the water column. As water column temperatures became more uniform in August they also started a gradual decline. Temperatures dropped from 13°C in mid August to 9°C in mid September when the final sampling was conducted.

Secchi depths for these delta front habitats ranged from 20-120 cmwith a mean of 70 cm. Water clarity at the delta front was thus greater than in active distributaries and channels, and equal to or somewhat less than in lakes and minor inactive distributaries (Table 4-2).

Mid Delta Platform

The delta platform consists of the area from the outer edge of the coastal mudflats to the approximate outer limit of shorefast ice in the winter. This zone may extend 20-30 km seaward from the coast. The delta platform slopes very gradually (1:1000 or less) until reaching the delta front. With the exception of the sub-ice channels which cross the platform, depths in this habitat are less than 3 m. Sampling in this habitat was limited to the sub-ice channels in the southern portions of this habitat but was over the shallow waters off the north mouth area. Sampling depths in this habitat averaged8 m with an overall range of 4 to 10 m.

This region was predominantly a fresh water habitat. Salinities averaged only 0.3 ppt at the surface and 0.4 ppt at the bottom. Over the entire summer season the highest salinity recorded in this area was 1.9 ppt. This measurement was recorded in mid September during the last sampling of this habitat. Water temperatures in this habitat were relatively warm and constant throughout the water column. The average temperature of surface water was 14.8°C while bottom water averaged 14.7°C. During the first sampling of this habitat in mid June, temperatures had already reached 12°C. By late July temperatures had peaked at 19°C. Temperatures then started to decline at a rate of 4-5 degrees per month reaching 10"C in early September.

Secchi disc depth readings were low (10-20 cm) with a mean of 14 cm, reflecting the flowing turbid river water character of these sub-ice channels during the summer time period.

Inner Delta Platform

The inner delta platform was defined as the habitat located just seaward of the intertidal zone (coastal mudflats). Mean water depth at stations monitored within this habitat was 2 m.

As a result of the shallow nature of this habitat, water quality conditions tended to be highly variable. Temperature averaged 14.8°C at the surface and 12.8°C near the bottom. These data, however, are somewhat misleading since measurements could be taken at both the surface and bottom only during high tides when colder offshore waters had moved inshore. During these times temperatures were nearly identical throughout the water column. Later in the summer season several measurements within this habitat suggested that water temperatures were two to three degrees warmer than in the main channels of the distributaries. Salinities in this habitat reached a maximum of 2.0 pptin mid August but averaged only 0.4 ppt.

Secchi disc readings in this shallow, active habitat were again low (10-20 cm) with a mean of 13 cm, essentially identical with those of the outer delta platform and very similar to those in the active distributaries further back in the delta.

Coastal Mudflat

The coastal mudflat habitat consists of the intertidal zone extending from the edge of the emergent delta to the delta platform. In some areas of the delta the coastal mudflats extend as much as 1.5 km offshore (Truett et al., 1985). Measurements of water quality within this habitat were not always possible since the tide was occasionally out when sampling gear was deployed. Water quality over the coastal mudflats was even more variable then in the inner delta platform habitat. Water temperature averaged 11.7°C but was recorded over the range from 5° to 21°C. Temperatures within this habitat were occasionally found to be far higher than those measured in other areas. As early as July 24, a temperature of 21°C was recorded over the mudflats. In September a temperature of 14°C was measured in this habitat while temperatures within the main distributaries of the river were 5 degrees lower. Due to the very shallow water depths, this area seemed to respond much more rapidly to air temperature and insolation (incoming solar radiation).

Salinities were typically less than 1 ppt (mean=0.9 ppt) but occasionally exceeded 2 ppt. The highest salinity encountered in this habitat was 3.6 ppt. These salinities are higher than those found at either the mid or inner delta platform habitats located further from shore. Since sampling was temporally sparse, this apparent anomaly was probably just a result of the timing of individual measurements. Secchi disc readings were again low (15 cm mean), essentially identical to the readings further offshore.

Coastal Slough

The coastal sloughs examined in this study consisted of relatively narrow dead end channels that opened to the coast. These sloughs were often dendritic, forming small drainages in the grass and sedge meadows found along the seaward edge of the emergent delta. Sediments in these sloughs were typically composed of soft muds (silt/clay). Water depths in the sloughs were tidally influenced. Water depths in this habitat averaged only 1 m. During low tide some coastal sloughs were often drained of water. At high tide, water depths reached a maximum of 2 m in these habitats.

Water quality in the coastal sloughs was generally similar to that of the coastal mudflats. Temperatures averaged 10.5″C and salinity averaged 1.0 ppt. From June through July temperatures gradually increased from 8° to 18°C. Salinities during this same time period were normally 0 to 0.1 ppt. By early August temperatures were already starting to decline. Water salinity increased only slightly during the latter part of the summer when most measurements ranged between 0.6 and 2.1 ppt.

Water quality measurements taken in association with a 24-hour study on August 27 indicated that both temperature and salinity did not fluctuate substantially on a diurnal basis. Temperatures measured during this study ranged from 9" to 10"C while salinities were between 1.1 and 2.1 ppt.

Secchi disc depths were somewhat higher than the delta front, platform, or distributary readings, being 10-60 cm with a mean of 27 cm. This coastal slough habitat is apparently a less turbulent flow regime than the offshore habitats or active tributaries, but with considerably more water movement than quiet water habitats of minor inactive tributaries or lakes.

Major Active Distributary

The major active distributaries are the large river channels ranging from 0.5 to 3 km wide that flow year round and extend seaward as subsea (summer) or sub-ice (winter) channels (Truett et al . 1985). Water velocities in these channels are extremely high in early summer but decline rapidly later in the open water season. Water depths in this habitat were often quite deep due to scouring. Areas sampled during the summer study averaged 9 m with some sites attaining depths of up to 15m.

The high flows in the major distributaries maintained low salinities/conductivities throughout most of the summer. Salinities, both at the surface and near the bottom, were 0.1 ppt or less through the middle of August. During this time period conductivities increased steadily from .059 to .300 mmhos/cm. As flows declined in the latter portion of the survey (i.e. early September) small increases in salinity occurred in all three major distributaries. Salinities measured during the final synoptic survey (i. e., September 4-14) ranged from 0.4 to 0.6 ppt. No salinity intrusions occurred during any of the positive storm surge events. This probably resulted from the relatively fresh water which was present on the delta platform also.

Water temperatures in this habitat averaged 14.6°C. Water temperatures ranged from 9° to 19°C with temperatures increasing through June and July, reaching a maximum in late July and then declining to a minimum in September at the end of the sampling. Due to the high current the water in the major distributaries was found to be well mixed from top to bottom. The largest measured vertical difference was only one degree centigrade for temperature and 0.2 ppt for salinity. Secchi disc depths were again low (10-20 cm), characteristic of turbulent flowing river waters.

Minor Active Distributary

Minor active distributaries are defined as the relatively narrow distributaries that branch off the lower portion of the major distributaries. Water velocities are lower in this habitat in comparison to those in the major distributaries. Water depths are correspondingly less. Sites sampled during the summer survey averaged only three meters and ranged from one to six meters in depth.

This can be characterized as a freshwater habitat with a thermal regime similar to that found in the major distributaries. Both salinities and conductivities were among the lowest recorded during this study. The average salinity was 0.0 ppt and conductivities averaged 0.1 mmhos/cm. Temperatures averaged 15.8°C over the season. This average is slightly higher than reported in the major active distributaries but temperatures were similar when measurements were compared for similar time periods. Secchi disc depths were shallow (10-20 cm), characteristic of flowing river water.

Minor Inactive Distributary

Minor inactive distributaries are those smaller distributaries that no longer connect to the ocean except perhaps during flood conditions. These older distributaries typically form dead end channels that open into either minor or major active channels. These shallow channels form a depositional environment where water velocities are low and depths are shallow. Water depth at both stations sampled within this habitat was 2 m.

The physical characteristics of this habitat were not well documented since measurements were taken on only two occasions. Both sets of measurements were taken in late June. During the first sampling of this habitat (18 June) water temperature was 15*C. This was two to three degrees warmer than in the adjoining active distributary. On the second sampling of this habitat (21 June) temperatures were comparable to those recorded in the major distributaries. Conductivities in this habitat averaged 0.1 mmhos/cm reflecting those measured in the major distributaries in late June.

Secchi disc depths were much higher than those for the habitats discussed above (60-90 cm; mean 75 cm), reflecting the more quiescent water of these inactive tributaries.

Lake

This habitat consisted of lentic environments which were surrounded by delta marsh but were connected to other delta channels by small outlet streams. Two different sites were sampled within this habitat type. Both were quite shallow with depths of 1 m or less.

Salinity/conductivity measurements varied slightly among the two sites. Salinities at station 9-1 never exceeded 0.0 ppt and conductivities were always .130 mmhos/cm or less. Salinities at station 9-2 reached 0.2 ppt with conductivities from .367 to .422 mmhos/cm. Temperatures in this habitat were generally consistent with those measured during the same time period at other locations in the delta. During the first week in July temperatures averaged 15°C. By the end of August temperatures in this habitat had dropped to an average of 10"C. Secchi disc readings were again high (90-120 cm; mean 92 cm), reflecting clearer water in a quiesent environment.

Lake Outlet

The lake outlet habitat type consists of small drainage channels that connect the shallow delta lakes either directly with major or minor active distributaries or with other habitats that are confluent with major or minor distributaries. This was a very shallow water environment with depths ranging from one to two meters.

Near continuous sampling within this habitat provided a good physical characterization of this environment. Temperatures averaged 14.1°C over the summer survey. On a daily basis temperatures measured within this habitat were similar to water temperatures in the major distributaries but exhibited more variability. Temperatures were occasionally a degree cooler in the lake outlets but were never warmer than waters in the active distributaries. Conductivities in this environment were typically very low but tended to increase over the course of the summer study. In mid June conductivities were as low as 0.05 mmhos/cm and by late August and September conductivities of 0.15 to 0.34 mmhos/cm were common. Secchi disc readings were again high, 50-220 cm, reflecting the quiet lake source water.

Ma.ior Inactive Distributar.v

This habitat is simply a former major distributary that no longer connects with the ocean. It differs from the minor inactive distributaries only in width. Like the minor inactive distributaries, this is a shallow water environment with low current velocities. Depths measured at sampling stations in this habitat were only 1 m on the two days that this habitat was sampled.

Water quality conditions did not vary from those of the major distributaries, however, measurements in this habitat were too minimal to characterize this environment. Sampling within this habitat occurred on June 16 and July 1. Temperatures measured on these dates ranged from 13° to 15°C. Conductivities were recorded at 0.1 mmhos/cm. Secchi disc readings were somewhat higher (20-30 cm; mean 27) than in the more active areas.

Inter Island Channels

This habitat type represents only a small portion of the Yukon Delta study area. The inter island channels consist of very narrow channels that cross the low relief islands that form near the mouths of the major distributaries. Water velocities in these channels appear to be relatively low and are driven primarily by the tides. Sediments in these channels consisted of extremely soft silts and clays. These channels are very shallow and rarely exceed 1 m.

Sampling of this habitat took place on the 25th and 26th of August at only one location. The vertical water structure was isothermal, with temperatures being 12°C and salinities being 0.0 ppt. Conductivities measured 0.1 mmhos/cm. Water in this habitat was slightly more turbid than at other habitats, with secchi disk depths of 10 cm.

Land-Locked Lake

This habitat consisted of lentic environments which were surrounded by delta marsh and had no apparent outlet. Water exchange in this habitat would be expected to occur only during flooding associated with breakup or during storm surges which commonly occur in the fall. Only a single station (Figure 3-3) was sampled in this habitat. Water depths at this station were only 1 m.

Water quality measurements were only taken at this location during the 29th and 30th of August. During this time water conductivities (.048 to .059 mmhos/cm) were among the lowest recorded in the study area but water temperatures (10° to 11°C) were comparable to those recorded within other delta habitats. Secchi disc readings (120-130 cm; mean 125 cm) were the highest clarity water encountered for any habitat in the study.

5.1.2 Winter Habitat Conditions - Discrete Physical Measurements

Water quality measurements which were conducted during December 6 through December 13, 1984 included sampling of six sites and included a variety of habitat types. These habitat types included freshwater and brackish water areas, major distributaries, and sloughs.

Temperature ranged from 0.0°C in areas of freshwater down to -1.5°C in areas of brackish water as can be seen in Table 4-1. Water depths at the stations ranged from 2 to 4 meters.

Brackish water was found at three of the coastal sites and at one inland location along the Black River, Figure 3-2. Salinity values ranged from freshwater at most locations to 19.3 ppt at the bottom in Elongozhik Slough. At the two coastal stations near North Mouth (Okshokwewhik Slough and Okwega Pass) water was found to be fresh (0.0 ppt) and 0.0°C. Progressing west and south along the coast, brackish water of 13.8 to 19.3 ppt was found at Elongozhik Slough, 0.7 - 14.4 ppt salinity at Nunaktuk Island in the Middle Mouth, 15.0 - 16.7 ppt salinity in Bugomowik Slough, and fresh water at both stations near the South Mouth (Caseys Channel and Kwemeluk Junction). At the Black River site salinities ranged from 0.0 ppt at the surface to 14.1 ppt at the bottom. Of the four stations where brackish water was measured, Middle Mouth and Black River stations were found to have a 1 m thick fresh water lenses over the saline water. In the case of the Black River site, the saline intrusion extended at least 35 km up the river to the sampling location.

Qualitative estimates of turbidity were made by visually observing and noting the water clarity. The water was clear at all stations where freshwater was found. At Bugomowik Slough and Elongozhik Slough where brackish water was measured at the surface the water was found to be slightly turbid. Dissolved oxygen during the sampling ranged from 10.5 to 14.2 parts per million (ppm). The highest values were found at the Black River site. No correlation was found between dissolved oxygen and other water quality parameters.

5.1.3 Dynamics of Physical Processes

Prior to the start of the field program, the study area was stratified into thirteen potentially different habitats based on river flow, water depth, location, and expected water quality conditions. After analysis of the physical characteristics of the Yukon Delta study area, it became evident that there wasn't always a clear distinction between the thirteen habitat types.

Salinity was found to be 0.0 ppt in almost all of the habitats between June and August with a maximum reading of 3.5 ppt in the nearshore zone. Higher salinities were recorded at station 4-4 which was located in the nearshore area approximately mid-way between the south and middle mouths of the Yukon River. As river discharge decreased during the latter part of summer, marine waters penetrated to the coast resulting in a low but significant increase in salinity. An examination of a false color-infrared Landsat image of the delta that was taken in late July 1975, indicates the presence of two less turbid coastal zones located in the region surrounding Station 4-4 and in the northern region in between the middle and north mouths of the Yukon River. This suggests the presence of a marine water return zone which would influence the salinity and water quality of the nearshore waters located in between the major distributary mouths.

The only habitat where marine conditions were measured was the delta front. The delta front is a depositional zone seaward of the delta platform and the furthest habitat offshore where sampling could be accomplished safely from a small boat. Temperature and salinity were highly stratified at this location throughout the whole summer with stratification intensifying in August and September. The increase in stratification probably resulted from decreased river discharge, which would mean less freshwater was available to the delta area, allowing marine water to intrude further onto the delta platform. River discharge would be expected to decline through fall and early winter allowing marine water to intrude further onto the delta platform eventually reaching the coastline, and then migrating up the deeper river channels. Winter sampling during December 1984 confirms these marine intrusions; salt water was found as far as 35 km inland along the Black River.

The large freshwater discharge of the Yukon River controls the water quality of the major and minor active distributaries, sloughs, and nearshore areas extending out past the delta platform. The river's huge sediment load reduces water clarity to a minimum in most areas. The only areas of relatively clear water were in the brackish water on the delta platform, in lakes, or in the inactive distributaries where the suspended sediment had a chance to settle out. The deepest Sechi disk reading was 220 cm at a lake outlet, with the most shallow being 10 cm, which was measured at a number of habitats with high currents or intense wind mixing on the delta platform.

Jones and Kirchoff (1978) indicated the presence of clear-water zones in the mudflats located between major river distributaries. A close examination of these sites indicated the presence of highly turbid waters (i.e., Secchi disk readings of 10 to 20 cm at Stations 4-1 and 4-4) during high tide and relatively clear waters in the broad shallow tidal pools (i.e., 5-10 cm deep) during low tide. During the high tide, waves and coastal currents stir up the fine sediments in the mudflats reducing water clarity to levels similar to the active distributaries. These were the conditions which were measured during the sample program. However, during low tide the mudflats in the intertidal zone become exposed and suspended sediment in the shallow tidal pools settles out enough for the bottom to be clearly visible.

Temperature was found to have a very high spatial correlation throughout the delta. The only temperature differences noted between continuous recording instrumentation locations were in the strength of the diurnal temperature fluctuation. Areas of shallow water responded much more readily to fluctuations in either air temperature or insolation. It is difficult to compare the discrete temperature sampling between habitats since large temporal differences are known to exist from the continuous measurements. Temperature varied over 1.0°C diurnally and up to 5°C over a week period at the same location. In general, water temperatures were around 10"C in early June at the beginning of the sampling. Temperatures gradually increased through June and July,reaching a maximum of 20°C in early August, after which point they began a steady decline. A minimum temperature of 5°C was reached at the end of September. It seems that seasonal and short term temporal temperature changes, which could be large,are much more important than spatial differences, which were small. The only temperature fronts that were measured were on the delta platform in conduction with the marine bottom layer, which was found at distances of 20-30 km from shore.

Water level in the river was fairly constant through most of the summer, although there was a slow decline in August and an increase during September. The difference between highest high water and lowest low water measured in the river was 1.0 m at Naringolapak Slough. This was the only site representing river conditions since the other recording gauges were located at the coast. No tidal oscillations could be discerned in the record at this site. A couple of small storm surges did occur, however, which were reflected by water level increases at the coastal sites. The largest of these occurred September 1 and 2 when the river level increased 0.2 m, then declined 48 hours later. Other than these few events, little correlation was observed between this inland site at Naringolapak Slough and the coastal sites at the heads of the three main distributaries.

Water levels at the three coastal sites were influenced mainly by astronomical tides and surge events associated with local wind speed and direction, storm events, and barometric pressure forcing. A number of surge events were found to correlate very well between all three of the coastal sites, with the highest correlation occurring between the North Mouth and the South Mouth. The Middle Mouth site seems to have been sheltered from both storm surges and tides as a result of shoals extending across the distributary mouth, which caused wind waves to break. The tidal range at this site was less than half of that predicted for the area by the 1985 NOAA/NOS Tide Tables (1984). The highest positive storm surge occurred September 1 and 2 with a range of 1.5 m at North Mouth, 0.8 mat Middle Mouth, and 1.2 m at South Mouth. Winds during this period were 10-23 knots from the southwest at Emmonak. Positive storm surges also occurred between August 6 and 15 during wind periods of 10-18 knots from the southwest. A meteorological time series would have been very useful for cross correlating with storm surge events, but only the surface weather observations at Emmonak were available. These observations were taken only for a 12-hour period each day.

Tides at the coastal sites were mixed at the South Mouth, which gradually changed to diurnal at the North Mouth bordering Norton Sound. Tides approach the area from the south with approximately 2 hours lag between the South and North Mouths. A large diurnal inequality (i.e., the difference in height between successive high or low waters) can be seen in the tidal plot for the South Mouth. This inequality increases at the Middle Mouth and at the North Mouth the tide has become almost entirely diurnal. As a resultof the configuration and depth of Norton Sound, the bay resonates at diurnal frequencies and increases the influence of diurnal constituents for the region. Semidiurnal constituents still have similiar magnitudes at both the North and South Mouth sites, which results in an increase in tidal range for the North Mouth site. The extent that tides travel up the river distributaries was not determined since the recording gauge deployed a short distance upstream from the South Mouth was lost, and the other meter at Naringolapak Slough showed no tidal influence.

5.2 POPULATION STRUCTURE DISTRIBUTION AND HABITAT ASSOCIATIONS

5.2.1 Juvenile Salmon

Chinook Salmon

The small catch of juvenile chinook salmon suggests that either the fishing gear was ineffective, effort was insufficient, or fish were not very abundant in the delta habitats during the period of sampling. It was unlikely that chinook were escaping the fishing gear, since a variety of gears were deployed and all gear had mesh small enough (i.e. 6.35 mm) to retain juvenile fish. Also, it is unlikely that juvenile chinook, which are strong swimmers, could have consistently avoided the active gear (i.e. purse seine or hooks seine) because hundreds of similar size fish and similar species of fish (i.e. sheefish, whitefish, and cisco) were caught during the survey.

Fishing effort was intermittent and was partitioned among many habitats and locations. Only several stations were sampled repeatedly throughout the summer. Therefore, the frequency of sampling may not have been enough to detect changes in the spatial and temporal distribution of juvenile chinook. Catches of juvenile chum, sheefish, whitefish, and cisco, however, were sufficient to identify temporal trends (Figures 4-4, 4-7, 4-10, 4-13). Additional fishing effort for these species would have better defined their temporal distribution within specific habitats, but would not have improved understanding of their general timing in delta habitats. This suggests the low catch of juvenile chinook was primarily a result of their low abundance during the sample period.

The majority of the juvenile chinook salmon outmigration probably occurred prior to the sample period (i.e. before June 14). Barton's (1983) survey of the Yukon River during June 7 through July 7, 1977 recorded 14 juveniles, of which most were caught during early June. This low catch concurs with the results of this study and suggests the peak of the outmigration may occur during or shortly after ice breakup.

Juvenile chinook were primarily associated with active distributary habitats. All fish, except one caught at the mudflat station 4-4, were caught in active distributaries or at stations located in close proximity to an active distributary (Figure 4-3). Other than the one fish caught in the mudflats there is no indication that juvenile chinook utilize the nearshore waters of the Yukon delta. However, this observation could be a function of the low sampling effort in coastal habitats during June and early July rather than lack of habitat utilization. These habitats were not sampled very often during the early summer period (i.e. before July 15) because of problems with access which prohibited travel to the coastal stations. Juvenile chinook are known to temporarily utilize the estuarine habitats of other major river deltas including: the Fraser River (Levy and Northcote, 1982), the Columbia River (Johnson and Sims 1973) and the Sacramento River (Kjelson et al. 1981). Therefore, it is likely that juvenile chinook utilize the Yukon Delta as well. Sampling immediately after ice breakup in the river and during early summer in coastal habitats would be needed to test this hypothesis.

Chum Salmon

Temporal trends in the catch of juvenile chum salmon indicates that peak catches occurred between June 25 - June 30 in the active distributary"ies. Catches declined to a low level by mid-July after which a few fish occurred intermittently throughout the rest of the summer (Fig. 4-4). The low catches observed at the beginning of sampling which were followed by large catches in late June suggests the peak of the outmigration occurred during the latter period. It is possible, however, that this apparent peak in abundance was a smaller mode in the outmigration pattern and a larger mode could have occurred prior to the sample period. During 1977 Barton (1983) found the peak outmigration occurred between June 13 and June 15. This difference in timing may also be due to natural variability in run timing and annual variations in weather. During 1985 ice breakup did not occur until June 7, whereas in 1977, breakup occurred at least one week earlier.

The results indicate that juvenile chum utilize the coastal habitats and the delta front during June through early August (Figure 4-4). Catches were low in these habitats compared to the active distributaries. But this may have been a result of limited sampling effort during June when abundance would likely be greater. No juvenile chum were found in these habitats after August 5 which suggests juveniles probably moved seaward of the delta front by this time. A similar pattern in habitat utilization was observed by Barton (1983) in Norton Sound during spring 1977. He found juvenile chum present in the nearshore waters of Golovin Bay with the onset of ice breakup and they remained in this habitat until about the second week of July. Juvenile chum from the Noatak River, which is just north of Seward Peninsula, enter Kotzebue Sound during mid to late-June and utilize the nearshore waters until mid-July (Merritt and Raymond 1983). Studies conducted in coastal waters of Southeast Alaska, British Columbia, and Puget Sound also show a similar orientation of juvenile chum toward shallow inshore areas (Lagler and Wright 1962; Mason 1974; Healey 1979; Levy and Levings 1978; Bax 1983; and Meyer et al. 1980).

Catches of juvenile chum salmon were more associated with temporal differences than spatial differences in water quality. Chum were most abundant in all habitats during late June when river discharge was high, temperature ranged 12-14°C, and salinity was low (1.0 ppt). The high, discharge and numerous distributary channels facilitates the dispersal of millions of juvenile chum along the extensive coastal habitats (i.e., tidal slough, mudflats and delta platform) that surround the Yukon River Delta. Water temperatures during this period were near the optimum for growth when fish are feeding at repletion levels (Brett et al. 1969). Since most chum stomachs were full of food (i.e., 85 percentof fish examined) the results suggest that food was not limiting at this time. As temperatures increased to 18-21°C by mid-July, the catches of juvenile chum declined. These higher temperatures are suboptimal for growth which suggests one reason why juvenile chum would move to the cooler waters offshore. Catches of juvenile chum were not associated with any spatial differences in habitat because water quality was similar among all habitats except the delta front. The cool waters in the delta front may have been more favorable for rearing during late July and early August when temperatures in the coastal habitats were high. However, the limited number of samples collected from the delta front during the summer was probably not sufficient to detect any transition in habitat preference. Juvenile chum could also have moved into the marine-water-return-areas that were identified from landsat imagery and were located in between the major distributaries. The catch of one juvenile chum in what appears to be a marine-water-return-area on the north coast (i.e., Station 5-12, Figure 3-2) during August suggests this hypothesis may be true. Unfortunately, a sufficient number of samples were not taken to confirm either the physical conditions or the habitat preference by juvenile chum.

The change in size of juvenile chum from a modal length of 40 mm during late June to a modal length of 50mm during late July and August (Appendix C Table 2) suggests temporary residency of juveniles could be occurring in the delta. Results of the otolith increment analysis suggests further that chum may be residing for periods of 13-29 days (Figure 4-6) and that fish may spend more time in some habitats than others (Table 4-12); although interpretation of the latter results must be viewed with some caution. The assumption that otolith increments produced in the edge zone were produced on a daily basis has not been validated for these fish. Laboratory studies under optimal conditions showed that 17 species out of 20 species deposit daily increments. However, in studies that examined increment deposition under suboptimal or extreme conditions, deposition was not daily in over half of the species (Jones 1986). Neilsen and Geen (1982 and 1985) found that changes in environmental variables (e.g., feeding frequency and diel temperature fluctuations) can increase the rate of increment formation in juvenile chinook salmon resulting in one or more growth increments per day. In the Yukon Delta, environmental conditions were probably not suboptimal for juvenile chum salmon. Maximum daily fluctuation of water temperature did not exceed 1.5°C and only 16 percent of the stomachs examined for food habits were empty (Table 4-14). This suggests that deposition of increments was daily and that the period of residence probably ranged from 13-29 days. This estimate agrees with the estimates for chum residency times in the Nanaimo Estuary (Vancouver Island, B.C.) which varied between O and 18 days during two field seasons of mark and recapture studies (Healey 1979).

The second assumption,that the otolith edge zone corresponds to the period of delta/estuarine residency, is also unknown. Without comparisons of otoliths between upriver and delta fish it is impossible to know what ecological or physiological significance is attached to the edge zone examined. Similar otolith transitions observed in juvenile chum salmon corresponded to their release from a hatchery environment into Hood Canal (Volk et al MS). Neilson et al. (1985) have recognized a correspondence between changes in otolith microstructure and migration into an estuary for juvenile chinook salmon. It was suggested that the step-wise increase in increment width and intensity expressed at the transition reflects an improved feeding environment in the estuary resulting in increased growth rates. It is possible that a similar interpretation may hold true for chum migrating seaward through the Yukon Delta.

Pink Salmon

Juvenile pink salmon were caught from the beginning of sampling until August 2, but the majority of fish were caught during June (Figure 4-5). Low numbers of fish prohibited the detection of an outmigration pattern other than the identification of the end of the outmigration. The rapid decline in catch shortly after sampling began suggests the peak of the outmigration probably occurred prior to June 14. The result of Barton's (1983) survey of the Yukon River concur with these findings, since he only caught 6 juvenile pink salmon and all were taken before June 21. In the Susitna River, Alaska the pink salmon outmigration begins immediately after ice breakup and the peak of the migration occured from early to mid-June during two years of study (ADF&G 1983a, 1984).

Pink salmon in the Yukon River Delta were not found in coastal nearshore habitats. Although effort was low in these habitats during June. Therefore it is possible that juveniles utilized these habitats hut were not detected at this time. Juvenile pink salmon were found in the nearshore waters of Golovin Bay, Norton Sound, primarily during June and no fish were taken after July 7 (Barton 1983). Increased sampling effort in the coastal habitats of the Yukon Delta during late July and early August indicates that juveniles did not utilize these habitats at this time.

The results indicate that juvenile pink salmon migrated directly through the delta platform and out to the delta front. Most fish ranged in size from 30-40 m which suggests that residence time in the delta was minimal. Pink salmon in the Fraser River spend little time in the delta and move offshore into the river plume (Barraclough and Phillips 1978). Residence time for pink salmon in the Fraser River Delta was found to be no more than a day or two (Levy et al. 1979).

5.2.2' Other Salmonids

Sheefish. Whitefish. and Cisco

Sheefish, whitefish, and cisco accounted for 65 percent of the total catch during the summer survey and were the most widely distributed of all species in the Yukon River Delta. Juveniles of all three groups passed through the active distributaries during their downstream migration, moved into and out of lakes adjacent to the river, and were most concentrated in the coastal mudflats and sloughs. All three groups were found in low numbers on the delta platform and only cisco were caught in significant numbers in the delta front.

These results indicate the coastal habitats were of primary importance as rearing areas for juvenile fish. Juveniles entered these habitats in early to mid-July and remained past the end of sampling in September. Juveniles would have to move out of shallow water habitats by winter since these areas become frozen to the bottom. Small sheefish, whitefish, and cisco were not caught in the deeper coastal habitats during December 1984, but large adult fish were present. The absence of the small fish may be more a result of size selectivity of the gill nets rather than an indication of no utilization at this time. The shallow coastal waters of the outer Mackenzie Delta were the most important habitats for juvenile rearing during the summer and the delta lakes and channels were used extensively for overwintering (Percy 1975).

Timing of the downstream migration of juvenile sheefish, whitefish, and cisco was readily identified in the catches from minor active distributary habitats (Figs. 4-7g, 4-10f, and 4-13g) . Sheefish moved through the delta during the first two weeks of July. Juvenile whitefish began significant movements during the third week of July with peak catches occurring during the last week of July. Cisco migration patterns were similar to the migration timing of whitefish. Barton (1979) observed a similar trend in the timing of the sheefish, whitefish, and cisco outmigration during his study of the Yukon River in 1977.

During the juvenile outmigration period all three groups of coregonids were observed moving into and immediately out of the lake outlet channel. Samples from the lake indicated that no juvenile whitefish or juvenile cisco utilized the lake habitat, and only a small number of juvenile sheefish were caught. Therefore, these data suggest that juvenile fish were probably not actively seeking the outlet channel or lake habitats. Rather, these fish may have been temporarily entrained in inactive sloughs or channels during the incoming tide, but rapidly found their way out of these habitats during the ebb tide. Turbid river water was observed moving into and out of inactive distributary channels with the fluctuating tides.

Sheefish, whitefish, and cisco were mostly found in areas of freshwater or areas of low salinity (i.e., less than 3 ppt). Juvenile cisco was the only coregonid species that occurred in the delta front where salinities ranged up to 19.9 ppt. In Norton Sound, Barton (1979) found the greatest abundance of cisco and whitefish in brackish water areas and sheefish were only captured in the Yukon River.

5.2.3 Non-salmonids

Nonsalmonid species that utilized the Yukon River delta can be placed into three general categories based upon their life history strategies (Table 4-8). These included marine, anadromous and freshwater species. A total of ten marine species were collected in the region of the Yukon Delta but the majority were not abundant in the collections nor directly dependent upon delta habitats for completion of a phase of their life history. The four most significant marine species were arctic flounder, saffron cod, starry flounder and Pacific herring. The first three species are demersal while the fourth, Pacific herring, is pelagic. Among the four anadromous species collected in the delta only two, boreal smelt and ninespine sticklebacks, were present in substantial abundances in delta habitats. Six freshwater species were collected in the study area but only two, burbot and pond smelt, were abundant.

The following discussion focuses on those marine, anadromous or freshwater nonsalmonid species that were abundant, important to either subsistence or commercial fisheries, or of ecological significance in the region.

Arctic Flounder

The arctic flounder was the numerically dominant marine species collected in the Yukon Delta during the summer. This relatively small, slow-growing species is known to inhabit shallow littoral and strongly freshened coastal waters during the summer and has a preference for muddy bottoms (Andriyashev 1954). Flounder were strictly limited in their distribution to coastal and offshore habitats (Table 4-10). The majority were caught in the inner delta platform, coastal mudflats and sloughs. It is probable that arctic flounder were also abundant over much of the shallow water habitat of the delta platform and delta front but sampling gear used in these areas was not designed to sample demersal species.

Within the mudflat habitat, occurrences and abundances of arctic flounder were associated with those of a similar species, the starry flounder (Table 4-10). This association may be a reflection of their comparable feeding habits (Fechhelm, 1985; Orcutt 1950).

Arctic flounder have been reported to reach maturity at lengths greater than 150 mm (Fechhelm, et al. 1985). Very few of the arctic flounder caught in the Yukon River delta area were that large, suggesting that the majority of the fish which utilized the study area were juveniles.

The mudflat and coastal slough habitats served as nursery areas for the arctic flounder during the summer months. A large proportion of the catch within these habitats were within two size classes, one from 20 to 30 mm and a second from 70 to 80 mm.

Saffron Cod

Saffron cod are usually found in relatively cold water areas to depths of less than 60 m. Within Norton Sound, this species has been estimated to represent nearly 50% of the total biomass of demersal fish (Wolotira et al. 1977). In this study, the majority of saffron cod were taken from the delta front in August and September, and from the mudflats and coastal sloughs in September (Table 4-10).

Saffron-cod became common in the delta front, mudflats and coastal slough catches late in the survey. The larger cod (modal length = 250 to 280 mm FL) were found in the nonsaline waters of the sloughs and mudflats while smaller cod with a range of 70 to 110 mm in length were found only in the brackish delta front habitats.

The late season movement of large saffron cod into the coastal region of the delta is consistent with the inshore spawning migration noted in other studies (Svetovidov, 1948; Andriyashov 1954; Barton, 1979; Wolotira, 1985). The juveniles were restricted to far offshore. They did not enter the study area in abundance until August when bottom salinities at the delta front increased to 16 ppt or greater. Since our surveys did not extend out past the delta front, it is not possible to assess the importance of the delta front habitat to juvenile saffron cod.

Starry Flounder

The starry flounder is one of the most widely distributed flounders and is the most abundant flatfish in Norton Sound (Wolotira et al. 1980). The majority of the starry flounder caught in this study were taken from the mudflats and coastal sloughs in July and August (Figure 4-18). However, selectivity of the purse seine gear could have attributed to low delta front and mid-delta catches.

During our summer survey, small young-of-the-year individuals were uncommon in the entire survey area. Most starry flounder collected in the coastal habitats ranged from 120 to 170 mm, a size range generally associated with age 1+ fish (Orcutt 1950). Neither spawning habitats nor location of young-of-the-year flounder were identified in this study. It is suspected that spawning and early development occurs further offshore as a result of the seaward extent of freshwater during the late spring and early summer.

Pacific Herring

The only herring caught in this study were taken in the deeper waters of the delta front. No larval or young-of-the-year herring were found in the nearshore habitat which suggests that the Yukon delta does not represent an important spawning and rearing area for the species.

Boreal Smelt

Throughout the summer months, boreal smelt were most common in habitats seaward of the emergent delta with the highest numbers collected in the region of the delta front. Smelt captured in the study area tended to be small but varied in size composition, both temporally and spatially. The overall size composition was similar to that reported for smelt collected with beach seines in Norton Sound during the summer (Barton 1977). A similar predominance of smaller size classes has been observed in summer fyke net collections near Pt. Lay in the Chukchi Sea (Fechhelm et al. 1985) and near the Colville River in the Beaufort Sea (Craig and Haldorson 1981).

Based upon age, length and size at maturity relationships for fish collected in the Beaufort Sea (Haldorson and Craig 1984), it would be expected that most fish captured in our study area were less than four to five years old and still sexually immature. Age, length and size at maturity relationships, however, can vary substantially among populations.

Spawning of boreal smelt is reported to occur in fresh water (Musienko, 1970). After hatching the young drift downstream into lakes or estuaries. In our survey of the Yukon River delta there was little evidence of a pulse of young boreal smelt. The smallest size class of boreal smelt captured during the summer (40 to 60mm FL) was collected in June in a minor active distributary but abundances were relatively low. A large, brief pulse of small smelt passing through the minor active distributaries in August may have been boreal smelt but species identification of these small smelt was not made.

Ninespine Sticklebacks

In the 1985 Yukon delta survey the ninespine sticklebacks was found in ten habitats and was present throughout the duration of the survey (Table 4-l(J). The majority were caught in coastal slough habitats, although they were also common in the brackish waters (up to 19.9 ppt) of the delta front.

Because of their small size, ninespine sticklebacks were not well sampled by any of our sampling gear. In the coastal slough, where abundances were the highest, sticklebacks were observed to move freely through the webbing of the tidal nets. Nevertheless, this habitat was clearly favored by sticklebacks.

Burbot

Burbot were caught in eight different habitats during the summer of 1985 in the Yukon delta project. However, they were not seen in the delta front or mid-delta platform. The majority of burbot were caught in July (Table 4-10) in the minor active distributary habitats. The species apparently avoids marine or brackish waters in the delta, which concurs with the findings of Andriyashev (1954).

From June 14 - 30 most of the burbot were caught in the coastal slough and minor active distributaries. During this time the smaller fish (70 - 130 mm) were present only in the sloughs. In July most of the burbot were caught in the minor active distributaries and most were less than 50mm long, suggesting that a younger age class had moved into the sampling area.

Pond Smelt

Pond smelt are normally considered a freshwater species in Arctic regions but have been known to venture out into brackish waters further to the south (McPhail and Lindsey 1970). The largest catches of these fish in this study occurred in the delta front in August and September (Table 4-15). Salinities in these habitats never exceeded brackish levels.

The only pond smelt caught in June in this study were from the coastal slough habitats (Table 4-15) and were from 90 to 100 mm FL. It is possible that the coastal sloughs are utilized by these larger, presumably mature, fish for spawning areas.

5.3 FOOD HABITS

5.3.1 Principal Diet Components and Feeding Dependency

The general trend in prey resource utilization across the delta habitats includes utilization of: (1) drift and epibenthic (aquatic larvae) insects in distributary habitats; (2) epibenthic organisms (mysids, copepods, amphipods) in coastal slough, mudflat, and inner delta platform habitats; and, (3) planktonic copepods in mid-delta platform and delta front habitats (Table 5-1). These generalities, however, would hold only for the more opportunistic fishes. Some species appeared to have rather specialized feeding behaviors in these habitat "regions." For instance, both boreal smelt and sheefish fed upon epibenthic mysids from the delta front to coastal slough habitats, and juvenile pink salmon foraged on epibenthic insect larvae in all habitats in which they occurred except the delta front.

In the absence of any indication of the prey resources available to the fish within each habitat stratum, and within microhabitat "intrastrata" (e.g., neustonic layer, water column, epibenthic boundary layer, benthic substrate, etc.), it is nearly impossible to ascribe dependency of any of these fishes to particularly prominent components of their diets. The alternative sources of prey cannot be identified without this information. Despite this major data gap, it is evident

TABLE 5-1

PRINCIPAL DIET COMPONENTS[a/] OF ELEVEN TAXA OF JUVENILE SALMON AND NON-SALMONID FISHES IN MARINE, ESTUARINE, AND FRESHWATER HABITATS OF THE YUKON RIVER DELTA, JUNE-SEPTEMBER 1985

Delta Habitat	Fish Taxa[b/] BRC	LSC	HBW	PKS	CHS	COS	CNS	SHE	PSM	BSM	BUR
delta front	Pc	Pc, Di		Pc	Pc, Di				Pc	Em, Pc	
mid-delta platform		Di			Di, Pc					Em	
inner delta platform		Ea, Pc	Ec, Em			Es	Es	Em, Ea	Em	Em, Fs	Em
mudflat	Em	Pc, Ea	Ea, Pc					Em, Ea			
coastal slough		Pc, Ea	Ec, Pc	Ei	Di, Es			Em	Pc, Ea		Em, Fs
major active distributary		Di	Di, Pc	Ei, Pc	Di			Di, Pc	Pc		Ei, Di
minor active distributary		Di	Di, Ec	Ei, Pc	Di		Di	Di, Pc			Ei, Eo

a/ Di = drift insects; Ea = epibenthic amphipods; Ec = epibenthic copepods; Ei = epibenthic insects (larvae); Em = epibenthic mysids; Eo = epibenthic ostracods; Es = epibenthic isopods; Fs = fish; Pc = pelagic copepods

b/ BRC = Bering cisco; LSC = least cisco; HBW = humpback whitefish group; PKS = pink salmon; CHS = chum salmon; COS = coho salmon; CNS = chinook salmon; SHE = sheefish; PSM = pond smelt; BSM = boreal smelt; BUR = burbot.

that a restricted number of prey species appear prominently across most of the diets and, as such, may constitute "requisite" prey for these fishes during their residency or migration through the delta. These would include:

Insects;

drift adults - Chironomidae

epibenthic larvae - Chironomidae

Planktonic cladocerans;

Bosmina

Daphnia

Podon

Planktonic copepods;

Eurytemora

Epischura

Epilabidocera longipedata

Epibenthic copepods;

Tachidius

Epibenthic mysids;

Neomysis

Epibenthic amphipods;

Haustoriidae

Epibenthic isopods;

Saduria entomon

Fish;

Pungitis pungitius

The reader should be aware of some tentative assumptions in several of these classifications, however. The ubiquitous estuarine calanoid copepod, Eurytemora sp., although commonly classified as a planktonic organism, is often found to be epibenthic in behavior and may be available in the same microhabitat as Neomysis and Tachidius. Similarly, we might presume that chironomid larvae are epibenthic on the substrate and vegetation surfaces but, in fact, they may be captured by the fish at the water surface. Microhabitat distribution studies of these particular prey assemblages will be required before the location of the actual foraging events can be established.

Nested within the fish sampling design deployed in 1985 is also a potential bias affecting the interpretation of the diet compositions for these fishes. Any collection method which results in prolonged retention (e.g., greater than 10-15 min.) of the fish specimens introduces the probability of effects upon prey digestion (especially in the case of fish which have died at the time of sampling) and upon prey consumption within the confines of the sampling gear (so-called "net-feeding") which would not be representative of the fishes' diets in situ. In particular, there is some suggestion that the fyke nets set in coastal sloughs and on the mudflat, which are passive samplers compared to the beach and purse seines, may have caused higher than normal consumption of some epibenthic crustaceans which were entrained and concentrated (i.e., became "abnormally" available) within the net with live fish specimens. The representation of gammarid amphipods, Neomysis sp., and Saduria entomon almost exclusively in the diets of fish from fyke net samples is suspected in the cases of humpack whitefish, sheefish, and burbot. Burbot had also consumed fish (so prominent in their diet) only in cases of fyke net-derived collections.

One of the more notable gaps in the food web linkages to these fishes is the absence of benthic infauna which is, perhaps, primarily an indication of the lack of sampling emphasis on demersal fishes per se. It is interesting, however, that none of the eleven species of concern in this study utilized benthic organisms to any extent.

5.3.2 Seasonal Shifts in Diets

Knowledge of seasonal shifts in the diets of juvenile fishes is desired to determine how spilled petroleum might affect food availability at crucial periods of migration. Attempts were made to ascertain differences in food composition of juvenile fish species as their migration periods passed from summer to autumn. Statistical resolutions of these differences were not possible since seasons could not be replicated with only one year of sampling. Alternatively, diet compositions of juvenile fishes were examined informally (without statistical rigor) to detect apparent trends developing over July, August, and September of 1985.

Most attempts at identifying dietary shifts did not reveal temporal patterns that would provide reasonable indicators of change. While a few dietary shifts over time appeared to be evident, most stomach analyses showed varities of food items that were too diverse to suggest temporal feeding patterns. Evidence of dietary seasonal shifts was suggested only by humpback whitefish, sheefish, and boreal smelt. In each of these cases the evidence appeared only for single habitat types; such dietary shifts throughout deltaic habitats for any juvenile species were not apparent.

Juvenile humpback whitefish feeding in deltaic distributaries appeared to shift from harpacticoids and cyclopoids in the summer to exclusively ephemeropterans in the fall (Table 4-18). In the same habitat, juvenile sheefish appeared to feed mostly on calanoid and cyclopoid copepods in early July but were more heavily dependent on dipterans in August (Table 4-21). They also fed heavily on gammarids in the mudflats during July but appeared to shift to mysids by September. Juvenile boreal smelt appeared to feed heavily on small teleosts in the delta platform habitat during June, but by August they fed exclusively on mysids in the same habitat (Table 4-23).

Further attempts at interpreting these diet composition data would be unwise. Variations of diet compositions within sampling times, and variations of same within habitats sampled, seem to be too great to permit definitive conclusions about seasonal variations. Therefore, implications derived from a non-statistical examination of these data are that reliable interpretations of seasonal shifts will require additional seasons of replication and the application of appropriate statistical analyses. Until this is accomplished, attempts to associate food availability with potential consequences of spilled petroleum would not be profitable.

5.3.3 Comparisons With Previous Studies

To our knowledge, this is the first study of food web relationships of fishes in this region of Alaska. As a result, comparisons can only be drawn from adjacent nearshore and estuarine regions, essentially all of which derive from prior OCSEAP studies.

Earlier investigations in Norton Sound (Barton 1979, Wolotira et al. 1979; see Drury and Ramsdell 1985 for synthesis) were concentrated on fish stocks available for human consumption and, as such, did not assess nearshore and estuarine habitat utilization by juvenile salmon and non-salmonid fishes and, more relevantly, did not include food habits data.

The OCSEAP (1978) synthesis of ecosystems in the Beaufort/Chukchi seas describes key fish species in this region as feeding extensively upon epibenthic invertebrates and zooplankton, including amphipods, mysids, isopods and copepods. In particular, in the intensively studied area of Simpson Lagoon, the mysids Mysis litoralis and M. relicts and amphipods Onisimus glacialis and Apherusa glacialis were considered to be important food items for both anadromous and marine fishes.

Fechhelm et al. (1985) included some of the most recent results on nearshore fishes in the northeastern Chukchi Sea. In general, anadromous fishes such as ciscoes, whitefishes, and juvenile salmonids were relatively uncommon in their collections and typically restricted to adults, rather than juvenile life history stages. As a result, comparable diet information was available only for rainbow smelt. In addition, their sampling methods (fyke net and gill net collections over long durations) were not appropriate for quantitative comparisons, although the qualitative data on overlapping species is relevant. Boreal smelt were considered to be "strongly piscivorous," feeding upon Arctic cod; Mysis littorals was the only other prominent prey.

The recent synthesis of the Beaufort Sea ecosystem (Barnes et al. 1984) provided further evidence that epibenthic mysids (Mysis littorals and M. relicts) and amphipods (Onisimus glacial is, Pontoporeia affinis, P. femorata) constitute important prey resources for least cisco and boreal smelt. None of these studies, however, provided any data on the composition and relative availability of prey resources at the time of their fish food habits studies.

5.3.4 Sources of Principal Food Web Linkages

Food web linkages leading to the eleven principal salmon and non-salmonid fishes in the Yukon River delta would appear to be rather direct and uncomplex, often involving but one or two important prey resources. These particular prey resources, in turn, derive their trophic support from three basic sources and pathways of organic carbon:

1. Terrestrial wetland plant production, which is utilized directly by herbivorous insects and indirectly by detritivorous insects; ultimately, the detritus is exported from the emergent vegetation zone and deposited in channels and, potentially, washed out into major active distributaries and into the coastal environs where it becomes available (as fine particulate organic carbon or FPOC) as a food source for detritivorous organisms such as mysids, gammarid amphipods, and harpacticoid copepods;

2. Benthic microphyte (diatom) production, which is utilized directly by epibenthic crustaceans in the coastal slough, mudflat, and inner delta platform habitats which are shallow enough to permit light penetration to the sediment through the turbid coastal waters; and

3. Water column (phytoplankton) production, which is the primary food source of herbivorous planktonic copepods.

On the surface, given the potential for depressed phytoplankton production in the turbid, turbulent distributary and coastal waters of the delta, the delta’s extensive emergent marsh seems responsible for significant export of detrimental matter into the adjacent aquatic ecosystem, where it could be the dominant source of organic carbon to the estuarine-coastal food web explored in this study.

Considerably more elaborate studies would have to be implemented if this hypothesis were to be tested. In many instances, the food sources overlap or are indistinguishable, as in benthic diatoms and detritus particles in the surface sediment. Only laborious microscopic or biochemical tracer (e.g., stable carbon isotopes, 13C) techniques will provide more accurate definition of the actual food sources.

5.4 POTENTIAL IMPACTS OF OIL AND GAS DEVELOPMENT

The methodology used to determine the potential impacts of petroleum on fish involved numerous assumptions as a result of inadequacy of available data. Sampling in habitats in 1985 was patchy and each period/habitat combination was inadequately represented. Assumptions made about the distribution and abundance of species in the Yukon delta area attempted to simulate known and apparent patterns in distribution and life history. Critical periods in the life history may have been missed, which could affect the vulnerability ratings of the habitats. The assumptions made about the equivalence of relative abundances by gear type probably introduced some bias in the habitat ratings. Each habitat was sampled predominantly by one gear type. Ratings could be affected if the relative catches between gear types did not represent the same densities of fish in each habitat. This is not unlikely. Gear standardization is necessary if catches of each gear type are to be compared accurately. Unfortunately, there was an insufficient amount of overlap in the types of gear fished in any given habitat and period to permit gear standardization. The extent of the bias resulting from this assumption is unknown.

The available literature on the sensitivity of arctic species to petroleum does not adequately describe the effects of oil on species found on the Yukon delta. What is required is a measure of the acute and sublethal effects of oil on all Yukon delta species using standardized methods. Until such a study is done, the effects or presence of oil can only be estimated from known life history patterns and from oil impacts on similar species. The variability of reactions to petroleum and petroleum components within groups of similar species is considerable, and estimates of sensitivity of a species may be misleading.

Despite the numerous assumptions made, the relative impact ratings for each habitat are not unrealistic. The major and minor active distributaries were expected to have ratings more nearly equal, given the similarity of these two habitats. Both are of similar depth and velocity, and have similar availability of fish habitats. The difference in the overall ratings of these two habitats is likely due to the difference in gear efficiency between the purse seine and the hook net. The inner delta platform and tidal sloughs received the highest impact ratings, which was not unexpected, These areas represent typical highly productive estuarine areas, often used as feeding and nursery areas. The minor active distributaries also received high ratings. These ratings reflect the use of these areas for migration by anadromous species. The delta front and mid-delta platform received the lowest ratings, which may be artificially depressed due to bias of gear type and reduced amount of sampling. These offshore habitats generally represent areas of reduced species diversification, and are less important as feeding and nursery grounds. Therefore, it is not unexpected that these habitats were found to have the lowest impact rating.

Improved regularity of sampling, standardization of gear types, and better knowledge of species sensitivity would greatly improve the estimates of habitat vulnerability. Other factors not included in the ratings which potentially could affect the magnitude of an impact include the likelihood of oil reaching a habitat, consideration of the cultural value of fish species to the local economy and the potential impacts of oil on lower trophic levels as they affect the availability of prey items for fish.

The likelihood of oil reaching a specific habitat would be dependent upon physical processes (e.g., wind, waves and currents) for oil transport and the elevation and/or location of each habitat. Information on the former was not available but is currently being developed by an OCSEAP physical processes study (i.e., PU411O). Based on location and elevation however, each habitat can be ranked in order of their relative vulnerability to oil as follows:

1) Delta front and delta platform
2) Intertidal mudflats and tidal sloughs
3) Active distributaries
4) Inactive distributaries and connected lakes
5) Tundra lakes

Species of fish that occur in the delta front and delta platform would most likely be impacted by oil because these habitats are adjacent to the oil and gas lease areas (Figure 2-1). Since the inner delta platforms received the highest overall impact rating, as well, this habitat would have the greatest vulnerability to an oil spill. Active distributaries also received a high potential impact rating but would be less likely to receive an impact because marine waters do not penetrate into the delta during much of the open water period (i.e., during peak runoff, June through August). Inactive distributaties and tundra lakes would be the least likely to be impacted because oil could only reach these habitats by a large storm surge event.

The measurement of sociological and cultural importance of a fish species is difficult. The local economy depends primarily on the catch of chum salmon, but other species are very important on a seasonal basis (Wolfe, 1981). The measurement of a rating of community value is at best highly subjective and no attempt was made to include it.

The feeding study did not include an assessment of the composition and standing stocks of the prey assemblages potentially available to foraging fish in the delta habitats. Knowledge of prey resources would make possible an estimate of habitat dependency based on the sources of the principal prey in the diet. The sensitivity of prey to oil and abundance of prey items is expected to have a significant effect on the impact analysis. For example, juvenile pink salmon and juvenile chum salmon were found to have highly specific diets that consisted primarily of larval and adult dipteran insects. Dipteran (i.e., mostly chironomidae) are mostly likely produced in the tidal sloughs and distributary channels. Juvenile chum feed on dipteran within these habitats and on insects that drift from these habitats to the delta platform. Therefore, oil contamination of the food producing areas could also have a significant effect on food resources for juvenile salmon in the coastal areas as well.

6.0 SUMMARY AND RECOMMENDATIONS

It is evident from the results that the primary period of delta habitat utilization by juvenile salmon occurs during the period from ice breakup to mid-July. However, the run timing for each species and their distribution among the delta habitats needs to be better defined. The duration of residency within the delta varies by species but the magnitude of residency is not known for any species. The diet of juvenile salmon was extremely specific and limited to a narrow spectrum of drift, plankton, and epibenthic prey taxa. However, more data will be needed to confirm these results. Assessing feeding dependency on delta habitats will require information on the composition and standing stocks of the prey assemblages potentially available to the foraging fish community. At a minimum, a second field season in the Yukon River Delta will be required in order to fill data gaps identified from this investigation. The experimental design for a second year study should include the following recommendations:

- Fish sampling should be conducted for a period of 5 weeks, beginning immediately after ice-breakup and for a period of 2 weeks during early August. This timing of the sample program would coincide with the period of maximum habitat utilization and would provide the data needed to assess the relative importance of delta habitats to juvenile salmon.

- Fish sampling should be concentrated in coastal, delta platform, and delta front habitats that are representative of physical conditions within and outside of distributary plume areas.

- Samples should be taken frequently (i.e., every 2-3 days) at a selected set of representative stations, including one station in a major active distributary, in order to define the temporal trends in habitat utilization.

- Fish should be collected with a few types of active fishing gears which are comparable. This will enable: (1) comparisons of catch among all habitats, (Z) quantitative correlation with physical conditions, and (3) minimal bias of the stomach contents analysis.

- Salmon otoliths should be collected from upriver of the delta and from delta habitats in order to test the transition zone hypothesis. Furthermore, holding pen experiments should be conducted in order to determine otolith increment periodicity.

- Periodic fish stomach contents samples should be collected from all habitats where juvenile salmon occur.

- Composition and standing stock of prey resources in all habitats should be determined from samples of: surface drift and neuston, water column zooplankton, epibenthos, and, near surface benthos.

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APPENDIX A

WATER QUALITY DATA

APPENDIX A

Table 1. Surface Water Quality Data

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°c)	SECCHI DEPTH (x 0.1 m)	
01	1	6/21	1309	1	0.4	1000	0.5	10.0	1.2	
01	3	7/19	1645	1	7.6	12300	7.7	15.0	0.7	
01	1	7/22	1053	1	6.6	10800	6.7	14.0	1.2	
01	1	7/22	1145	1	6.5	10600	6.5	14.0	1.1	
01	2	7/26	1415	1	6.1	10000	6.1	15.0	1.0	
01	2	7/26	1525	1	6.1	10000	6.1	15.0	1.0	
01	3	8/10	1703	1	18.9	23900	15.8	13.0	0.7	
01	1	8/13	1334	1	11.1	14500	9.2	13.0	0.5	
01	3	8/16	1514	1	5.5	7400	4.4	12.0	0.3	
01	3	9/04	1623	1	12.5	15500	9.8	10.0	0.3	
01	2	9/10	1231	1	3.5	4400	2.5	9.0	0.2	
01	2	9/10	1445	1	3*5	4400	2.5	9.0	0.2	
					7.4	10400	6.5	12.4	.70	Ave
					4.9	6019	4.0	2.4	.39	Sav
					0.4	1000	0.5	9.0	.2	Min
					18.9	23900	15.8	15.0	1.2	Max

Number of Observations: 12

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°c)	SECCHI DEPTH (x 0.1 m)	
02	1	6/16	1749	1						
02	1	6/17	1221	1		60	0.0	12.0	0.2	
02	2	6/25	1612	1		50	0.0	13.0	0.2	
02	1	6/30	1707	1	0.4	920	0.4	14.0	0.2	
02	1	7/18	1300	1		160	0.0	18.0	0.1	
02	1	7/18	1515	1		170	0.0	17.0	0.1	
02	3	7/22	1315	1	0.4	880	0.4	19.0	0.2	
02	3	7/22	1410	1	0.7	1400	0.7	19.0	0.2	
02	2	7/26	1140	1		300	0.1	18.0	0.1	
02	2	7/26	1230	1		300	0.1	18.0	0.1	
02	1	8/10	1503	1		148	0.0	16.0	0.1	
02	2	8/11	1846	1	0.1	300	0.1	16.0	0.1	
02	2	8/11	1935	1	0.1	300	0.1	16.0	0.1	
02	1	8/16	1216	1		200	0.0	14.0	0.1	
02	1	8/16	1306	1		200	0.0	14.0	0.1	
02	1	9/04	1232	1	0.9	1200	0.6	11.0	0.1	
02	1	9/04	1335	1	0.9	1200	0.6	11.0	0.1	
02	2	9/09	1533	1	0.9	1500	0.8	10.0	0.2	
02	2	9/09	1620	1	0.9	1500	0.8	10.0	0.2	
					0.6	599	0.3	14.8	.14	Ave
					0.3	543	0.3	3.1	.05	Sav
					0.1	50	0.0	10.0	.1	Min
					0.9	1500	0.8	19.0	.2	Max

Number of Observations: 19

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP ("c)	SECCHI DEPTH (x 0.1 m)
03	1	6/24	1815	1		49		13.0	0.2
03	2	6/30	1327	1		84	0.0	13.0	0.1
03	6	8/04	1200	1	0.1	500	0.2	18.0	0.2
03	6	8/04	1200	1	0.1	500	0.2	18.0	0.2
03	3	8/13	1748	1		200	0.0	13.0	0.1
03	3	8/13	1800	1		200	0.0	13.0	0.1
03	3	8/13	1800	1		200	0.0	13.0	0.1
03	3	8/14	920	1	1.2	1900	1.0	12.0	0.1
03	5	8/18	943	1	0.1	435	0.2	16.0	0.1
03	5	8/19	805	1	1.9	3450	2.0	17.0	0.1
03	3	9/11	1330	1					
03	3	9/12	1025	1					
					0.7	751	0.4	14.6	.13 Ave
					0.8	1089	0.6	2.4	.05 Sdv
					0.1	49	0.0	12.0	.1 Min
					1.9	3450	2.0	18.0	.2 Max

Number of Observations: 12

04	1	6/27	1140	1				14.0	0.2
04	2	6/30	1430	1	0.4	900	0.4	12.0	0.1
04	4	7/24	1845	1	2.2	4000	2.3	21.0	0.2
04	5	7/30	1136	1	0.8	1550	0.8	13.0	
04	1	8/05	1115	1	0.2	580	0.2	18.0	0.2
04	6	8/07	1825	1		300	0.1	16.0	0.1
04	6	8/07	1850	1		300	0.1	16.0	0.1
04	6	8/08	2100	1		177	0.0	13.0	0.1
04	4	8/19	1220	1	0.5	1120	0.6		0.2
04	4	8/20	1605	1	0.3	680	0.3	16.0	0.1
04	4	8/20	1720	1	0.3	680	0.3	16.0	0.1
04	4	8/21	1605	1	0.7	1390	0.7		0.1
04	4	8/27	900	1	0.4	980	0.5	1o.o-	0.2
04	4	8/27	1100	1	0.5	1075	0.5	10.0	0.1
04	4	8/27	1100	1	0.5	1075	0.5	10.0	0.1
04	4	8/27	1300	1	0.8	1575	0.8	10.0	0.1
04	4	8/27	1302	1	0.8	1575	0.8	10.0	0.1
04	4	8/27	1456	1	0.7	1420	0.7	10.0	0.1
04	4	8/27	1510	1	0.7	1420	0.7	10.0	0.1
04	4	8/27	1805	1	0.9	1725	0.9	10.0	0.2
04	4	8/27	1820	1	0.9	1725	0.9	10.0	0.2
04	4	8/27	2005	1	2.1	3850	2.2	10.0	0.2
04	4	8/27	2014	1	2.1	3850	2.2	10.O	0.2
04	4	8/28	1150	1	0.1	480	0.2	9.0	0.2
04	6	9/1 1	2002	1					
04	6	9/12	1815	1	0.7	1500	0.8	9.0	0.1

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP ('C)	SECCHI DEPTH (x 0.1 m)	
04	1	9/15	1210	1	0.2	510	0.2	6.0	0..2	
04	1	9/16	1008	1	0.2	550	0.2	5.0	0.3,	
04	5	9/16	1655	1	2.7	4700	2.7	9.0	0.1	
04	5	9/17	1641	1	3.5	6100	3.6	14.0	0.1	
					0.9	1635	0.9	11.7	.15	Ave
					0.9	1480	0.9	3.6	.06	Sdv
					0.1	177	0.0	5.0	.1	Min
					3.5	6100	3.6	21.0	.3	Max

Number of Observations: 30

05	1	6/13	1300	1				8.0	
05	14	6/15	1545	1		62		9.0	0.1
05	14	6/15	1615	1		62		9.0	0.1
05	7	6/21	1130	1				14.0	0.4
05	4	6/23	1600	1		155	0.0	14.0	0.2
05	5	6/23	1745	1		330	0.1	14.0	0.3
05	6	6/23	1210	1				10.0	0.2
05	6	6/23	1820	1				13.0	0.3
05	6	6/23	915	1				10.0	0.2
05	8	7/08	1945	1		275	0.1	11.0	0.5
05	8	7/08	1945	1		275	0.1	11.0	0.5
05	9	7/08	1710	1		275	0.1	11.0	0.5
05	8	7/09	1145	1		155	0.0	14.0	0.2
05	8	7/09	1115	1		155	0.0	14.0	0.2
05	8	7/09	1115	1		155	0.0	14.0	0.2
05	8	7/09	1145	1		155	0.0	14.0	0.2
05	8	7/1 1	1205	1		210	0.0	14.0	0.2
05	8	7/11	1205	1		210	0.0	14.0	0.2
05	10	7/24	2200	1	0.4	900	0.4		0.2
05	12	8/05	1410	1	0.5	1150	0.6	18.0	0.6
05	12	8/05	1420	1	0.5	1150	0.6	18.0	0.6
05	13	8/07	2100	1	0.6	1220	0.6	14.0	0.3
05	13	8/07	2105	1	0.6	1220	0.6	14.0	0.3
05	13	8/07	2145	1	0.6	1220	0.6	14.0	0.3
05	13	8/07	2150	1	0.6	1220	0.6	14.0	0.3
05	13	8/08	1840	1		190	0.0	13.0	0.2
05	13	8/08	1930	1		190	0.0	13.0	0.2
05	10	8/19	1045	1	1.7	3175	1.8		0.2
05	10	8/19	1045	1	1.7	3175	1.8		0.2
05	10	8/20	1650	1					
05	10	8/20	1810	1					
05	10	8/27	935	1	1.7	3050	1.7	10.0	0.2
05	10	8/27	1130	1	1.9	3450	2.0	9.0	0.2
05	10	8/27	947	1	1.7	3050	-1.7	10.0	0.2

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)
05	10	0/27	1140	1	1.9	3450	2.0	9.0	0.2
05	10	8/27	1135	1	1.9	3450	2.0	9.0	0.2
05	10	8/27	1330	1	1.1	2075	1.1	10.(.I	0.2
05	10	8/27	1148	1	1.9	3450	2.0	9.0	0.2
05	10	8/27	1338	1	1.1	2075	1.1	10.0	0.2
05	10	8/'27	1334	1	1.1	2075	1.1	10.0	0.2
05	10	8/27	1539	1	1.1	2085	1.1	10.0	0.2
05	10	8/27	1344	1	1.1	2075	1.1	10.0	0.2
05	10	8/27	1549	1	1.1	2085	1.1	10.0	0.2
05	10	8/27	1543	1	1.1	2085	1.1"	10.0	0.2
05	10	8/27	1838	1	2.0	3650	2.1	10.0	0.2
05	10	8/27	1558	1	1.1	2085	1.1	10.0	0.4
05	10	8/27	1852	1	2.0	3650	2.1	10.0	0.4
05	10	8/27	1848	1	2.0	3650	2.1	10.0	0.4
05	10	8/27	2030	1	2.0	3675	2.1	10.0	0.4
05	10	8/27	1859	1	2.0	3650	2.1	10.0	0.3
05	10	8/27	2041	1	2.0	3675	2.1	10.0	0.3
05	10	8/27	2034	1	2.0	3675	2.1	10.0	0.3
05	10	8/27	2048	1	2.0	3675	2.1	10.0	0.3
05	10	8/28	1243	1	1.1	2075	1.1	9.0	0.3
05	13	9/11	1905	1	0.6	1300	0.7	7.0	0.2
05	13	9/11	1905	1	0.6	1300	0.7	7.0	0.2
05	13	9/'12	1610	1	0.6	1200	0.6	8.0	0.3
05	13	9/12	1610	1	0.6	1200	0.6	8.0	0.3
05	12	9/15	1254	1	0.3	720	0.3	6.0	0.3
05	12	9/15	1254	1	0.3	720	0.3	6.0	0.3
05	11	9/16	1650	1	1.6	3000	1.7	7.0	0.3
05	11	9/16	1700	1	1.6	3000	1.7	7.0	0.3
05	12	9/16	1202	1	0.5	1100	0.5	6.0	0.3
05	12	9/16	1225	1	0.5	1100	0.5	6.0	0.3
05	11	9/17	1610	1	1.6	3000	1.7	7.0	0.3
05	11	9/17	1610	1	1.6	3000	1.7	7.0	0.3
					1.2	1793	1.0	10.5	.27 Ave
					0.6	1303	0.8	2.8	.11 Sdv
					0.3	62	0.0	6.0	.1 Min
					2.0	3675	2.1	18.0	.6 Max

Number of Observations: 66

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)
06	1	6/17	1851	1		59		12.0	0.1
06	2	6/19	1944	1		59		13.0	0.2
06	3	6/25	1212	1		43		13.0	0.2
06	3	6/25	1316	1		43		13.0	0.2
06	1	7/04	1345	1		100	0.0	14.0	0.2
06	1	7/15	1400	1		150	0.0	16.0	0.2

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP ("c)	SECCHI DEPTH (x 0.1 m
06	1	7/15	1530	1		155	0.0	16.0	0.2
06	1	7/17	1315	1		155	0.0	17.0	0.2
06	1	7/17	1635	1		155	0.0	17.0	0.1
06	2	7/21	1615	1		160	0.0	18.0	U.2
06	2	7/21	1712	1		170	0.0	18.0	0.2
06	3	7/25	1430	1		190	0.0	18.0	0.2
06	3	7/25	1650	1		190	0.0	19.0	0.1
06	1	8/10	1118	1		200	0.0	16.0	0.2
06	1	8/10	1223	1		200	0.0	16.0	0.2
06	3	8/1 1	1535	1		200	0.0	16.0	0.1
06	3	8/11	1624	1		200	0.0	16.0	0.1
06	2	8/12	1506	1		300	0.1	16.0	0.1
06	2	8/12	1720	1		300	0.1	16.0	0.1
06	2	8/12	1601	1		300	0.1	16.0	0.1
06	2	8/12	1720	1		300	0.1	16.0	0.1
06	3	8/12	1224	1		200	0.0	16.0	0.1
06	3	8/12	1224	1		200	0.0	16.0	0.1
06	2	8/14	1128	1		300	0.1	15.0	0.2
06	3	8/14	1600	1		300	0.1	15.0	0.1
06	1	8/15	1156	1	0.1	300	0.1	14.0	0.1
06	1	8/15	1243	1	0.1	300	0.1	14.0	0.1
06	1	8/30	1353	1		1775		11.8	0.2
06	1	9/05	1543	1	0.6	900	0.4	11.0	0.2
06	3	9/1'0	1735	1	0.7	1200	0.6	10.0	0.2
06	3	9/10	1815	1	0.7	1200	0.6	10.0	0.2
06	2	9/13	1254	1	0.8	790	0.5	9.0	0.2
06	2	9/13	1346	1	0.8	790	0.5	9.0	0.2
					0.5	726	0.3	14.6	.16 Ave
					0.3	1841	1.1	2.7	.05 Sa
					0.1	43	0.0	9.0	.1 Mi
					0.8	7900	0.5	19.0	.2 Ma

Number of Observations: 34

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP ("c)	SECCHI DEPTH (x 0.1 m
07	1	6/15	1935	1		56		10.0	0.1
07	2	6/20	1522	1		44		14.0	0.2
07	2	6/20	1553	1		44		14.0	0.2
07	3	6/20	1808	1		39		13.0	0.1
07	3	6/20	1834	1		39		13.0	0.1
07	4	6/22	1554	1		50		13.0	0.2
07	5	6/26	1417	1		159	0.0	11.0	0.2
07	5	6/26	1445	1		159	0.0	11.0	0.2
07	7	6/28	1421	1		42		14.0	0.1
07	8	6/28	1902	1		64		14.0	0.2
07	8	6/28	1929	1		64		14.0	0.2
07	8	7/'02	1947	1		100	0.0	14.0	0.2

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP ("c)	SECCHI DEPTH (X 0.1 m)
07	8	7/02	2010	1		100	0.0	14.0	0.2
07	8	7/07	1030	1		105	0.0	15.0	0.2
07	8	7/07	1055	1		105	0.0	15.0	0.2
07	8	7/09	1315	1		150	0.0	14.0	0.2
07	8	7/09	1340	1		150	0.0	14.(J	0.2
07	8	7/09	1340	1		150	0.0	14.0	0.2
07	8	7/09	1335	1		150	0.0	14.0	0.2
07	8	7/1 2	1605	1		155	0.0	15.0	0.1
07	8	7/12	1315	1		155	0.0	15.0	0.1
07	8	7/12	1315	1		155	0.0	15.0	0.1
07	8	7/'12	1635	1		155	0.0	15.0	0.1
07	9	7/'12	2040	1		160	0.0	17.0	0.2
07	9	7/12	2115	1		160	0.0	17.0	0.2
07	8	7/17	1930	1		160	0.0	17.0	0.1
07	8	7/17	2003	1		160	0.0	17.0	0.1
07	2	7/21	1246	1		140	0.0	18.0	0.2
07	2	7/'21	1305	1		140	0.0	18.0	0.2
07	3	7/22	1635	1		170	0.0	19.0	0.2
07	3	7/22	1700	1		170	0.0	19.0	0.2
07	10	7/25	1902	1		200	0.0	19.0	0.2
07	10	7/25	1920	1		200	0.0	19.0	0.2
07	8	8/0 1	1537	1		146	0.0	19.0	0.1
07	8	8/01	1555	1		146	0.0	19.0	0.1
07	3	8/02	1947	1		144	0.0	19.0	0.2
07	3	8/02	2050	1		144	0.0	19*O	0.2
07	3	8/02	2020	1		144	0.0	19.0	0.2
07	3	8/02	2050	1		144	0.0	19.0	0.2
07	8	8/02	1300	1		148	0.0	19.0	0.1
07	8	8/02	1300	1		148	0.0	19.0	0.1
07	10	8/02	1621	1		146	0.0	20.0	0.2
07	10	8/02	1722	1		146	0.0	20.0	0.2
07	10	8/02	1645	1		146	0.0	20.0	0.2
07	10	8/02	1722	1		146	0.0	20.0	0.2
07	2	8/03	1535	1		160	0.0	20.0	0.1
07	2	8/03	1645	1		160	0.0	20.0	0.1
07	2	8/03	1618	1		160	0.0	20.0	0.1
07	2	8/03	1645	1		160	0.0	20.0	0.1
07	9	8/06	1237	1		172	0.0	18.0	0.2
07	9	8/06	1337	1		172	0.0	18.0	0.2
07	9	8/06	1302	1		172	0.0	18.0	0.2
07	9	8/06	1337	1		172	0.0	18.0	0.2
07	8	8/'07	1035	1		148	0.0	18.0	0.2
07	8	8/07	1200	1		148	0.0	18.0	0.2
07	8	8/07	1105	1		148	0.0	18.0	0.2

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP ('C)	SECCHI DEPTH (x 0.1 m
07	8	8/07	1200	1		148	0.0	18.0	0.2
07	2	8/12	1820	1		200	0.0	15.0	0.1
07	8	8/15	1357	1	0.1	300	0.1	15.0	0.1
07	8	8/15	1418	1	0.1	300	0.1	15.0	0.1
07	8	8/22	945	1		175	0.0	13.0	0.1
07	8	8/22	1110	1		175	0.0	13.0	0.1
07	8	8/22	1004	1		175	0.0	13.0	0.1
07	8	8/'22	1110	1		175	0.0	13.0	0.1
07	8	8/30	1157	1		162	0.0	13.0	0.2
07	8	8/30	1316	1		162	0.0	13.0	0.2
07	8	8/30	1225	1		162	0.0	13.0	0.2
07	8	8/30	1316	1		162	0.0	13.0	0.2
07	2	9/13	1038	1		210	0.0	9.0	0.2
07	2	9/13	1131	1		210	0.0	9.0	0.2
07	8	9/18	1038	1		190	0.0	8.0	0.2
07	8	9/18	1107	1		190	0.0	8.0	0.2
					0.1	148	0.0	15.8	.17 Av
					0.0	49	0.0	3.2	.05 Sd
					0.1	39	0.0	8.0	.1 Mi
					0.1	300	0.1	20.0	.2 Ma:

Number of Observations: 72

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP ('C)	SECCHI DEPTH (x 0.1 m
08	1	6/18	1305	1		66		15.0	0.6
08	1	6/'18	1411	1		6'6		15.0	0.6
08	2	6/21	2015	1		57		12.0	0.9
08	2	6/21	2020	1		57		12.0	0.9
						61	0.0	13.5	.,7.5 Av
						4	0.0	1.7	.17 Sd
						57	0.0	12.0	.6 Mi
						66	0.0	15.0	.9 Ma

Number of Observations: 4

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP ('C)	SECCHI DEPTH (x 0.1 m
09	1	7/05	1545	1		75	0.0	15.0	1.2
09	1	7/05	1400	1		75	0.0	15.0	1.2
09	1	7/05	1645	1		75	0.0	15.0	1.2
09	1	7/05	1700	1		75	0.0	15.0	1.2
09	1	7/06	1130	1		79	0.0	16.0	
09	1	7/06	1115	1		79	0.0	16.0	
09	1	7/06	1135	1		79	0.0	16.0	
09	1	8/22	1545	1				10.0	

HAB	LOCDATE		TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP ("C)	SECCHI DEPTH (x 0.1 m
09	1	8/23	1025	1		130	0.0	9.0	0.4
09	2	8/23	1345	1	0.1	422	0.2	10.0	0.6
09	2	8/23	1430	1	0.1	422	0.2	10.0	0.6
09	2	8/24	2015	1	0.1	390	0.1	10.0	0.7
09	2	8/24	2040	1	0.1	390	0.1	10.0	0.7
09	2	8/24	2049	1	0.1	390	0.1	10.0	0.7
09	2	8,/25	1340	1	0.1	367	0.1	10.0	0.5
					0.1	217	0.0	12.5	.82 Av
					0.0	162	0.1	2.9	.32 Sa
					0.1	75	0.0	9.0	.4 Mi
					0.1	422	0.2	16.0	1.2 Ma

Number of Observations: 15

10	3	6/18	1625	1		47		13.0	1.0
10	3	6/18	1635	1		47		13.0	1.0
10	1	6/29	1428	1				12.0	
10	1	6/29	1428	1				12.0	
10	1	6/30	1100	1				12.0	
10	1	6/30	1101	1				12.0	
10	1	6/30	1100	1				12.0	
10	1	6/30	1101	1				12.0	
10	1	7/03	1100	1		90	0.0	12.0	2.1
10	1	7/03	1130	1		90	0.0	12.0	2.1
10	1	7/03	1100	1		90	0.0	12.0	2.1
10	1	7/03	1130	1		90	O*(J	12.0	2.1
10	1	7/05	1320	1		90	0.0	13.0	2.1
10	1	7/05	1400	1		90	0.0	13.0	2.1
10	1	7/05	1320	1		90	O*O	13.0	2.1
10	1	7/05	1400	1		90	0.0	13.0	2.1
10	1	7/06	1215	1		82	0.0	15.0	
10	1	7/06	1315	1		82	0.0	15.0	
10	1	7/06	1305	1		82	0.0	15.0	
10	1	7/06	1315	1		82	0.0	15.0	
10	1	7/09	1815	1		115	0.0	12.0	2.2
10	1	7/'09	1800	1		115	0.0	12.0	2.2
10	1	7/09	1800	1		115	0.0	12.0	2.2
10	1	7/09	1815	1		115	0.0	12.0	2.2
10	1	7/14	1100	1		117	0.0	14.0	2.1
10	1	7/14	1210	1		117	0.0	14.0	2.1
10	1	7/14	1100	1		117	0.0	14*O	2.1
10	1	7/14	1210	1		117	0.0	14.0	2.1
10	1	7/'16	1620	1		120	0.0	19.0	1.5

HAB	LOC	DATE	TIME	S\B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m
10	1	7/16	1720	1		120	0.0	19.0	1.5
10	1	7/16	1620	1		120	0.0	19.0	1.5
10	1	7/16	1720	1		120	0.0	19.0	1.5
10	1	7/23	1200	1		150	0.0	19.0	0.8
10	1	7/23	1315	1		150	0.0	19.0	0.8
10	1	7/23	1200	1		150	0.0	19.0	0.8
10	1	7/23	1315	1		150	0.0	19.0	0.8
10	1	7/29	1215	1		150	0.0	17.0	0.8
10	1	7/29	1345	1		150	0.0	17.0	0.8
10	1	7/29	1315	1		150	0.0	17.0	0.8
10	1	7/29	1345	1		150	0.0	17.0	0.8
10	1	8/01	1158	1		146	0.0	17.0	0.5
10	1	8/01	1330	1		146	0.0	17.0	0.5
10	1	8/0 1	1243	1		146	0.0	17.0	0.5
10	1	8/01	1330	1		146	0.0	17.0	0.5
10	1	8/07	1555	1		148	0.0	17.0	0.7
10	1	8/07	1645	1		148	0.0	17.0	0.7
10	1	8/07	1615	1		148	0.0	17.0	0.7
10	1	8/07	1645	1		148	0.0	17.0	0.7
10	1	8/12	1955	1		170	0.0	15.0	0.6
10	1	8/12	2020	1		170	0.0	15.(I	0.6
10	1	8/12	1955	1		170	0.0	15.0	0.6
10	1	8/12	2020	1		170	0.0	15.0	0.6
10	1	8/18	1800	1		142	0.0	17.0	0.8
10	1	8/18	1810	1		142	0.0	17.0	0.8
10	1	8/18	1800	1		142	0.0	17.0	0.8
10	1	8/18	1810	1		142	0.0	17.0	0.8
10	1	8/22	1650	1		149	0.0	12.0	
10	1	8/22	1725	1		149	0.0	12.0	
10	1	8/22	1710	1		149	0.0	12.0	
10	1	8/22	1725	1		149	0.0	12.0	
10	2	8/23	1303	1	0.1	340	0.1	12.0	1.1
10	2	8/23	1303	1	0.1	340	0.1	12.0	1.1
10	2	8/25	1203	1		275	0.1	11.0	0.5
10	2	8/25	1208	1		275	0.1	11.0	0.5
10	2	8/25	1142	1		275	0.1	11.0	0.5
10	2	8/25	1148	1		275	O*1	11.0	0.5
10	2	8/26	1325	1		315	0.1	11.0	0.8
10	2	8/26	1437	1		315	0.1	11.0	0.8
10	2	8/26	1325	1		315	0.1	11.0	0.8
10	2	8/26	1437	1		315	0.1	11.0	0.8
10	1	8/29	1404	1		155	0.0	11.0	1.0
10	1	8/29	1430	1		155	0.0	11.0	1.0
10	1	8/29	1423	1		155	0.0	11.0	1.0
10	1	8/29	1430	1		155	0.0	11.0	1.0
10	1	9/08	1958	1		100	0.0	10.0	2.0
10	1	9/08	2025	1		100	0.0	10.0	2.0

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)	
					0.1	151	0.0	14.1	1.20	Ave
					0.0	69	0.0	2.8	.63	Sdv
					0.1	47	0.0	10.0	.5	Min
					0.1	340	0.1	19.0	2.2	Max

Number of Observations: 76

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)	
11	1	6/16	2110	1				15.0	0.2	
11	2	7/01	2005	1		115	0.0	13.0	0.3	
11	2	7/01	2030	1		115	0.0	13.0	0.3	
						76	0.0	13.7	.27	Ave
						66	0.0	1.2	.06	Sdv
								13.0	.2	Min
						115	0.0	15.0	.3	Max

Number of Observations: 3

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)	
12	1	8/25	1702	1		140	0.0	12.0	0.1	
12	1	8/25	1735	1		140	0.0	12.0	0.1	
12	1	8/26	1116	1		146	0.0	12.0	0.1	
12	1	8/26	1151	1		146	0.0	12.0	0.1	
12	1	8/26	1100	1		146	0.0	12.0	0.1	
12	1	8/26	1151	1		146	0.0	12.0	0.1	
						144	0.0	12.0	0.1	Ave
						3	0.0	0.0	0	Sav
						140	0.0	12.0	0.1	Min
						146	0.0	12.0	0.1	Max

Number of Observations: 6

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)	
13	1	8/29	1642	1		48		10.0	1.2	
13	1	8/29	1714	1		48		10.0	1.2	
13	1	8/30	1700	1		59		11.0	1.3	
13	1	8/30	1645	1		59	0.0	11.0	1.3	
						53	0.0	10.5	1.25	Ave
						6	0.0	0.6	.06	Sdv
						48		10.0	1.2	Min
						59	0.0	11.0	1.3	Max

Number of Observations: 4

Table 1. Surface Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP (°C)	SECCHI DEPTH (x 0.1 m)	
					1.6	1037	0.5	13.5	3	Ave
					2.6	2406	1.5	3.4	0	Sav
					0.1	39	0.0	5.0	3	Min
					18.9	23900	15.8	21.0	4	Max

Number of Observations: 353

APPENDIX A

Table 2. Bottom Water Quality Data

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP °C	
01	1	6/21	1309	2	0.4	1000	0.5	4.0	
01	3	7/19	1645	2	14.0	21500	14.1	15.0	
01	1	7/22	1053	2	10.1	16000	10.2	8.0	
01	1	7/22	1145	2	9.3	14800	9.4	10.0	
01	2	7/26	1415	2	10.1	16000	10.2	13.0	
01	2	7/26	1525	2	10.1	16000	10.2	13.0	
01	3	8/10	1703	2	22.8	27700	18.6	12.0	
01	1	8/13	1334	2	11.4	14900	9*4	13.0	
01	3	8/16	1514	2	20.9	25200	16.8	11.0	
01	3	9/04	1623	2	26.4	29500	19.9	10.0	
01	2	9/10	1231	2	26.0	28900	19.5	9.0	
01	2	9/10	1445	2	26.0	28900	19.5	9.0	
					15.6	20033	13.2	10.6	Ave
					8.5	8524	5.9	2.9	Sdv
					0.4	1000	0.5	4.0	Min
					26.4	29500	19.9	15.0	Max

Number of Observations: 12

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC . SALINITY (ppt)	TEMP °C	
02	1	6/17	1221	2		65	0.0	12.0	
02	2	6/25	1612	2		48	0.0	13.0	
02	1	6/30	1707	2		100	0.0	14.0	
02	1	7/18	1300	2		165	0.0	18.0	
02	1	7)18	1515	2		180	0.0	18.0	
02	3	7/22	1315	2	0.8	1600	0.8	19.0	
02	3	7/22	1410	2	1.0	1900	1.0	19.0	
02	2	7/26	1140	2		300	0.1	18.0	
02	2	7/'26	1230	2		300	0.1	18.0	
02	1	8/10	1503	2		200	0.0	15.0	
02	2	8/11	1846	2	0.2	400	0.1	16.0	
02	2	8/11	1935	2	0.2	400	0.1	16.0	
02	1	8/16	1216	2		300	0.1	14.0	
02	1	8/16	1306	2		300	0.1	14.0	
02	1	9/04	1232	2	0.9	1200	0.6	11.0	
02	1	9/04	1335	2	0.9	1200	0.6	11.0	
02	2	9/09	1533	2	2.5	3400	1.9	9.0	
02	2	9/09	1620	2	2.5	3400	1.9	9.0	
					1.1	858	0.4	14.7	Ave
					0.9	1076	0.6	3.3	Sav
					0.2	48	0.0	9.0	Min
					2.5	3400	1.9	19.0	Max

Number of Observations: 18

Table 2. Bottom Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP °C	
03	2	6/30	1327	2		85	0.0	13.0	
03	3	8/13	1748	2		200	0.0	13.0	
03	3	8/13	1800	2		200	0.0	13.0	
03	3	8/13	1800	2		200	0.0	13.0	
03	3	8/14	920	2	1.3	1900	1.0	12.0	
					1.3	517	0.2	12.8	Ave
					0.0	774	0.5	0.4	Sav
					1.3	85	0.0	12.0	Min
					1.3	1900	1.0	13.0	Max

Number of Observations: 5

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP °C
06	1	6/17	1851	2		62	0.0	12.0
06	2	6/19	1944	2		58	0.0	13.0
06	3	6/25	1212	2		47	0.0	13.0
06	3	6/25	1316	2		47	0.0	13.0
06	1	7/04	1345	2		100	0.0	14.0
06	1	7/15	1400	2		150	0.0	17.0
06	1	7/15	1530	2		150	0.0	17.0
06	1	7/17	1315	2		160	0.0	17.0
06	1	7/17	1635	2		160	0.0	17.0
06	2	7/21	1615	2		170	0.0	18.0
06	2	7/2 1	1712	2		280	0.1	19.0
06	3	7/25	1430	2		185	0.0	19.0
06	3	7/25	1650	2		185	0.0	19.0
06	1	8/10	1118	2		200	0.0	16.0
06	1	8/10	1223	2		200	0.0	16.0
06	3	8/11	1535	2		200	0.0	16.0
06	3	8/1 1	1624	2		200	0.0	16.0
06	2	8/12	1506	2		300	0.1	16.0
06	2	8/12	1720	2		300	0.1	16.0
06	2	8/12	1601	2		300	0.1	16.0
06	2	8/12	1720	2		300	0.1	16.0
06	3	8/12	1224	2		300	0.1	16.0
06	3	8/12	1224	2		300	0.1	16.0
06	2	8/14	1128	2	0.1	300	0.1	15.0
06	3	8/14	1600	2	0.1	300	0.1	15.0
06	1	8/15	1156	2	0.1	300	0.1	14.0
06	1	8/15	1243	2	0.1	300	0.1	14.0
06	1	8/30	1353	2		180	0.0	12.0
06	1	8/30	1353	2		180	0.0	12.0
06	1	9/05	1543	2	0.8	1100	0.5	11.0
06	3	9/10	1735	2	0.8	1200	0.6	10.0
06	3	9/10	1815	2	0.8	1200	0.6	10.0
06	2	9/13	1254	2	0.9	1300	0.7	9.0
06	2	9/13	1346	2	0.9	1300	0.7	9.0

Table 2. Bottom Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP 'C	
07	8	8/15	1357	2	0.1	300	0.1	14.0	
07	8	8/15	1418	2	0.1	300	0.1	14.0	
07	8	8/22	945	2		172	0.0	13.0	
07	8	8/22	1110	2		172	0.0	13.0	
07	8	8/22	1004	2		172	0.0	13.0	
07	8	8/22	1110	2		172	0.0	13.0	
07	8	8/30	1157	2		1&o	0.0	12.0	
07	8	8/30	1316	2		180	0.0	12.0	
07	8	8/30	1225	2		180	0.0	12.0	
07	8	8/30	1316	2		180	0.0	12.0	
					0.1	157	0.0	16.0	Ave
					0.0	46	0.0	2.7	Sdv
					0.1	41	0.0	11.0	Min
					0.1	300	0.1	20.0	Max

Number of Observations: 51

HAB	LOC	DATE	TIME	S/B	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP 'C	
08	2	6/2 1	2015	2		58	0.0	11.0	
08	2	6/21	2020	2		58	0.0	11.0	
						58	0.0	11.0	Ave
						0	0.0	0.0	Sdv
						58	0.0	11.0	Min
						58	0 . 0	11.0	Max

Number of Observations: 2

6.1	2283	1.4	14.7	Ave
8.8	6445	4.3	3.2	Sdv
0.1	41	0.0	4.0	Min
26.4	29500	19.9	20.0	Max

Number of Observations: 122

Table 2. Bottom Water Quality Data (Continued)

HAB	LOC	DATE	TIME	S/13	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP °C	
					0.5	353	0.1	14.7	Ave
					0.4	375	0.2	2.8	Sdv
					0.1	47	0.0	9.0	Min
					0.9	1300	0.7	19.0	Max

Number of Observations: 34

HAB	LOC	DATE	TIME	S/13	INSITU SALINITY (ppt)	COND (umhos/cm)	CALC. SALINITY (ppt)	TEMP °C
07	5	6/26	1417	2		150	0.0	11.0
07	5	6/26	1445	2		150	0.0	11.0
07	8	6/28	1902	2		41	0.0	14.0
07	8	6/28	1929	2		41	0.0	14.0
07	8	7/02	1947	2		100	0.0	14.0
07	8	7/02	2010	2		100	0.0	14.0
07	8	7/07	1030	2		105	0.0	15.0
07	8	7/07	1055	2		105	0.0	15.0
07	8	7/09	1315	2		150	0.0	14.0
07	8	7/09	1340	2		150	0.0	14.0
07	8	7/09	1340	2		150	0.0	14.0
07	8	7/09	1335	2		150	0.0	14.0
07	8	7/1 2	1605	2		160	0.0	16.0
07	8	7/12	1315	2		160	0.0	16.0
07	8	7/12	1315	2		160	0.0	16.0
07	8	7/12	1635	2		160	0.0	16.0
07	9	7/12	2040	2		160	0.0	17.0
07	9	7/12	2115	2		160	0.0	17.0
07	8	7/17	1930	2		165	0.0	17.0
07	8	7/17	2003	2		165	0.0	17.0
07	2	7/21	1246	2		150	0.0	19.0
07	2	7/21	1305	2		150	0.0	19.(I
07	3	7/22	1635	2		180	0.0	19.0
07	3	7/22	1700	2		180	0.0	19.0
07	8	8/0 1	1537	2		155	0.0	19.0
07	8	8/0 1	1555	2		155	0.0	19.0
07	3	8/02	1947	2		146	0.0	20.0
07	3	8/02	2050	2		146	0.0	20.0
07	3	8/02	2020	2		146	0.0	20.0
07	3	8/02	2050	2		146	0.0	20.0
07	8	8/02	1300	2		144	0.0	19.0
07	8	8/02	1300	2		144	0.0	19.0
07	10	8/02	1621	2		148	0.0	19.0
07	10	8/'02	1722	2		148	O*O	19.0
07	10	8/02	1645	2		148	0.0	19.0
07	10	8/'02	1722	2		148	0.0	19.0
07	8	8/07	1035	2		150	0.0	17.0
07	8	8/07	1200	2		150	0.0	17.0
07	8	8/07	1105	2		150	0.0	17.0
07	8	8/07	1200	2		150	0.0	17.0
07	2	8/12	1820	2	0.1	300	0.1	16.0

APPENDIX B

CATCH PER UNIT EFFORT

APPENDIX B

Table 1. Catch Per 24-Hour Gill Net Set

						STATION							
DATE	S-2	S-3	s-6	8-1	.2-2	9-1	9-2	18-3	11-1	11-2	12-1	13-1
JUVENILE CHUM SALMON												
06/16/2s	.	3		.		.	.		.	.		.
07/02/85	.	.				.			.	0		.
ADULT CHUM SALMON												
9s/16/8s	.	3	.	.		.	.					
07/02/85	.	.	.	.	.		.		.	1		
SHEEFISH												
86/14/ss	56	.	.			.		.	.	.	.	
06/17/85	.	.		.	.	.	.	.	24	.	.	
06/19/85	.	.	.	' a	.	.	.	1	.	.	.	
06/22/85	.	.		.	1	.		.	.	.	.	
07/02/85	.	.	.	.		.	.	.	.	1		
HUMPBACK WHITEFISH												
06/14/85	72	.	.			.	.		.	.		.
06/17/ss	.	.		.	.	.		.	20	.		
06/19/85	.	.	.	3 2	.	.		13				
06/22/85	.	.			0	.			.	.		
07/02/85	,	.	.	.			.	.		14		.
08/24/85	.	.	.	.	.	.	4	.	.	.		.
BROAD WHITEFISH												
06/14/85	24				.	.				.	.	
06/17/85	.	.	.		.				4	.		.
06/19/85	.	.		7	.	.	.	1	.	.	.	.
07/02/85	.	.	.		.	.	.			4		
ARCTIC CISCO												
06/14/85	4	.		.	.	.	.	.	.	.	.	.
LEAST CISCO												
06/14/85	52	.		.	.	.	.	.	.	.	.	.
06/17/85	.	.		.	.	.	.	.	4	.	.	.
06/19/85	.	.		14	.	.		4	.			
86/22/8s	.	.		.	1	.	.	.	.	.		.
07/02/85	.	.	.	.		.		.		11	.	
08/24/85	.				.	.	1	.	.	.	.	
UNIDENTIFIED CISCO												
06/19/85	.	.	.	1	.		.	1	.	.		.
06/23/85	.	.	0	.	.	.		.	.		.	.
08/26/85	.	.	.		.	.	.		.	.	0	.
LONGNOSE SUCKER												
06/19/85	.	.	.	1	.			0	.	.		
07/02/85	.								.	1		
NORTHERN PIKE												
06/14/85	a	.			.	.	.	.	.		.	.
06/17/85	.	.	.	.	.	.	.	.	4	.		.
26/19/8s	.			8	.	.	.	12				
06/22/85	.	.		.	3	.	.	.		.	.	
07/05/85	.			.	.	9	.	.	.			
07/06/85	.		.	.	.	1	8 .	,			.	
08/24/85	.				.	.	2	.				
BURBOT												
06/14/85	4			.								
06/17/85	.	.				.	.	.	4	.	,	.
BLACKFISH												
08/30/85	.	.	.	.		.	.	.	.			12

APPENDIX B

Table 2. Catch Per 24-Hour Single Fyke Net Set

	STATION														
DATE	4-1	4-2	4-4	4-5	4-6	7-1	7-6	8-1	8-2	9-1	9-2	10-3	11-2	12-I	13-1
CHINOOK SALMON															
06/16/85	.				.	13		.		.	.		.		
08/21/85	.	.	1					.			.	.	.		.
JUVENILE CHUM SALMON															
06/16/85	.	.	.	.		8			.	.		.	.	.	.
07/30/85	.			2	.	.	.		.	.	.	.	.		
ADULT CHUM SALMON															
06/16/85	.	.				1			.		.		.	.	.
07/30/85	.		.	4		.			.	.		.	.	.	
PINK SALMON															
06/16/85	.				.	5	.		.	.	.			.	.
UNIDENTIFIED DOLLY VARDEN/ARCTIC CHAR															
07/30/85	.			1	.	.	.			.	.		.	.	.
SHEEFISH															
07/01/85	.	8	.	.	.	.		.	.	.		.	.	.	.
07/06/85	.		.	.		.	.			1	.	.	.	.	.
07/09/85	.		.	.	.	.	.	.		15	.		.	.	
07/24/85	.	.	587			.	.	.	.	.	.			.	.
07/30/85	.	.		175	.	.	.	.	.	.	.	.	.	.	.
08/04/85	26		'	.	.	.	.	.		.	.	.	.	.	.
08/05/85	17		'			.	.	.	.						.
08/07/85	.	.			11			.		.		.	.	.	
08/08/85	.				40	.	.	.	.			.	.		
08/20/85	.	.	37	.		.	.	.	.	.	.			.	.
08/21/85	.	.	246		.	.	.	.	.	.	.			.	.
08/28/85	.		113	.	.	.	.	.	.	.	.	.	.	.	.
09/12/85	.	.	.	.	2	.		.	.		.	.	.	.	.
09/16/85	101		.		.	.	.	.		.		.	.	.	
09/17/85	.			81		.	.	.		.		.	.	.	.
HUMPBACK WHITEFISH															
06/14/85	.	.	.	.	.	.	4	.	.				.	.	.
06/16/85	.		.	.	.	36							.	.	.
06/22/85	.		.	.	.	.			1	.		.	.	.	.
06/27/85	23	.		.	.		.	.	.	.	.			.	
07/24/85	.		13	.										.	.
08/04/85	5			.			.			.	.		.	.	.
08/05/85	4		.	.		.			.		.	.	.	.	.
08/07/85	.	.	.	.	3		.	.		.	.			.	.
08/08/85	.		.	.	4				.	.				.	.
08/20/85	.	.	8	.		.	.	.		.	.	.			.
08/21/85	.		7s	.	.			.			.	.	.		.
08/24/85	.				.	.		.			1			.	.
08/25/85	.	.		.		.			.		1		.	.	.
08/28/85	.		5	.			,		.				.	.	.
09/12/85	.	.			1										.
09/16/85	3		.	.	.		.			.	.		.		.

APPENDIX B

Table 2. Catch **Per 24-Hour** Single Fyke Net Set

							STATION								
DATE	4-1	4-2	4-4	4-9	4-6	7-1	7-6	8-1	s-2	9-1	9-2	10-3	11-2	12-1	13-1
BROAD WHITEFISH															
06/27/85	2	.		.	.	.			.	.		.	.	.	.
07/01/85	.	15		.	.		.	.	.	.	.	.		.	.
07/02/85	.	.	.	.	.	.						.	10	.	.
07/24/85	.	.	2	.	.		.			.	.				.
08/04/85	1	.	.	.	.	.	.		.	.	.				.
08/28/85	.	.	3	.	.		.	.	.	.	.				
09/12/85	.	#		.	1	.	.	.			.		.		
09/17/85	.	.	.	2		.	.	.		.	.	.			
UNIDENTIFIED WHITEFISH															
07/24/85	.		3813			.	.	.	.	.	.				
07/30/85	.		.	449	.	.			.			.			
08/04/85	4S3		.	.		.	.	.				.	.		
08/05/85	1962	.	.	.	.	.		.	.			.	.	.	.
0s/s7/85	.		.	.	2207	.	.	.		.		.	.		
08/08/85		.	.	.	836	.			.	.		.	.	.	
08/20/85	.	.	13	.				.				.	.		.
08/21/85			22	.	.		.	.	.		.		.		
08/25/85		.	.		.	.		.	.		1		.	.	.
08/26/85	.	#		.	.		.	.		.	.	.		3	
08/28/85			140	.	.	.						.			.
09/12/85					4		.	.		.	.		.		.
09/16/S5	1	.				.						.	.		.
09/17/85	.	.		3	.			.	.	.	.				.
BERING CISCO															
07/01/85		9		.	.		.		.	.				.	.
07/24/85		.	8		.	.	.	.		.	.				.
07/30/85		.		61	.					.	.			.	
08/04/85	9	.			.			.		.	.	.			.
08/05/85	1	.			.	.	.		.	.	.			.	.
08/07/85	.		.	.	7	.	.	.		.	.	.			
08/08/85	.	.		.	12		.	.	.	.	.				
08/21/85	.	.	6	.	.	.	.	.			.	.			.
08/28/85	.	.	4	.	.		.		.	.	.			.	.
09/12/85	.		.		14	.	.	.		.	.	.			.
09/16/2S	16	.			.				.	.				.	.
09/17/85	.	.	.	94	.	.		.			.	.	.		.
LEAST CISCO															
06/14/85	.		.			.	4	.	.	.	.	.			
06/16/2S	.		.	.	.	32		.			.	.	.		.
%/19/2s	.		.			.	.	1	.	.	.	0			.
06/20/85	.	.	.	.	.	.		2	.	.		0	.	.	.
06/22/85	.		.	.		.	.	.	25	.	.	.	.		.
06/27/s5	55	.	.	.	.	.		.	.	.	.	.	.	.	.
07/01/85	.	3s	.	.		.	.	.		.	.	.		.	.

APPENDIX B

Table 2. Catch Per 24-Hour Single **Fyke Net Set**

							STATION								
DATE	4-1	4-2	4-4	4-5	4-6	7-1	7-6	8-1	8-2	9-1	9-2	16-3	11-2	12-1	13-1
LEAST CISCO CONT.															
07/02/85	,			.			.	.		.	.	.	29	.	.
07/24/85	.	.	64	.	.	.	.	.	.				.		.
07/30/85	.	.	.	1	.	.	.		.	.	.	.	.	.	.
08/04/85	13				.	.	.		.	.	.			.	.
08/05/85	15	.	.		.	.		.	.	.				.	.
08/07/85	.	.	.	.	25		.	.		.	.		.	.	
08/08/85	.	.	.		13	.	.			.		.	.	.	
08/21/85	.		2	.	.	.	.	.	.		.	.	.	.	.
08/25/85	.		.	.			.	.		.	1		.	.	.
08/28/85	.	.	4	.	.	.	.		.				.	.	.
03/12/85	.	.	.	.	10	.	.	.		.	.	.	.	.	.
09/17/85	.	.		1	.	.	.	.	.		.		.	.	.
UNIDENTIFIED CISCO															
07/24/85	.		146						.	.		.		.	
07/30/85	.		.	94	.	.	.	.	.		.	.	.		.
08/04/85	7			.	.	.	.	.		.	.	.	.	.	.
08/05/85	140	.		.	.			.	.		.		.		.
08/07/85	.	.	,	.	87	.	.	.	.			.		.	.
08/08/85	.	.	.		77		.		.	.	.			.	.
08/20/85	.	.	3		.	.	.		.	.	.			.	.
08/21/85	.		42	.	.	.	.		.	.		.	.	.	
08/28/85	.		359						.	.				.	
09/12/85	.	.	.	.	12	.	.	.			.		.	.	.
29/16/2s	21		.	.	.	.	.	.			.	.	.	.	.
09/17/85	.			234	.		.				.		.		
UNIDENTIFIED CISCO AND WHITEFISH															
07/02/85		.				.	.	.					3		.
07/06/85	.	.			.	.		.		11	.	.	.		
07/29/2s	.	.					.		.	12		.	.		
07/30/85	.		.	1	.	.	.	.			.	.	.	.	.
BOREAL SMELT															
06/14/85				.	.	.	19	.	.					.	.
06116/2s						6			.		.	.	.	.	.
06/27/85	4	.			.	.	.	.	.		.			.	.
07/01/85		5	.	.	.	.	.	.	.	.	.	.	.	.	
07/24/85	.	.	2	.	.		.		.		.	.	.		
08/07/85	.	.	.	,	1	.	.	.		.	.	.	.	.	
08/08/85	.	.	,	.	7	.			.	.	.	.	.		
08/21/85	.		1	.	.	.	.	.			.	.	.	.	.
POND SMELT															
08/07/85		.	.	.	2	.	.	.	.	.	.		.	.	.
08/20/85	.	.	1	.	.	.	.	.	.	.	.	.	.		.
08/21/85	.	.	1	.			.	.	.	.			.	.	.
08/28/85	.	.	i ?	.	.	.	.	.	.	.		.	.	.	.
09/16/85	1	.		.	.	.		.	.	.	.		.	.	
09/17/85			.	9	.	.	.	.			.	.	.	.	

APPENDIX B
Table 2. Catch Per 24-Hour Single Fyke Net Set

DATE	4-1	4-2	4-4	4-5	4-6	7-1	STATION 7-6	8-1	0-2	9-1	9-2	12-3	11-2	12-1	13-1
THREESPINE STICKLEBACK															
07/01/85	.	1		.	.	.	.	.		.				.	.
NINESPINE STICKLEBACK															
06/14/85	.	.	.	.	.		1	.							.
06/16/85	.		.	.	.	2	.	.	.		.				.
06/22/85	.	.	.	.		.	.	.	4	.					.
07/01/85	.	2	.		.	.	.	.			.		.	.	.
07/06/85	.		.			.				1	.		.		
08/04/85	2		.		.	.	.	.	.		.				.
08/05/85	10			.	.	.	.	.			.	.			.
08/28/85	.		8		.	.	.	.			.				
09/16/85	1	.	.	.	.	.	.	.	.	.	.			.	
09/17/85	.		.	191	.		.	.	.						
LONGNOSE SUCKER															
06/16/85			.		.	2	.	.			.			.	
06/19/85	.		.			.	.	1	.		.	0	.	.	
07/22/25	.		.	.		.	.						4	.	
07/24/85			3		.	.	.				.		.	.	
08/07/85	.		.	.	3	.	.		.	.	.			.	.
08/08/85	.		.		s	.	.							.	
08/21/85	.		2	.	.	.	.		.			.		.	
08/25/85	.		.		.	.	.		.		1			.	
NORTHERN PIKE															
06/19/85	.		.	.	.	.	.	0	.	.	.	1		.	.
06/20/85	.		.		.	.	.	0	.		.	1	.	.	
07/06/85	.	.		.	.	.	.	.	.	1	.	.		.	.
07/30/85			.	1	.	.	.		.		.		.	.	.
08/23/85	.		.	.		.	.	.	.	4	.	.		.	
08/24/85	.		.	.	.	.	.	.	.	.	5	.	.	.	
08/25/85	.	.		.		.	.	.	.	.	4	.		.	.
BURBOT															
06/14/85	.	.		.	.	.	26	.		.		.		.	.
06/19/85	.	.	.	.	.	.	.	0	.		.	1	.	.	.
07/02/85	.	.	.	.	.	.	.		.	.	.	.	1	.	.
08/04/85	27		.		.	.	.	.	.	.	.		.	.	.
08/07/85	.	.		.	10	.	.	.	.	.	.	.		.	.
08/08/85			.	.	8	.	.	.	.		.	.	.	.	.
08/20/85	.		2	.	.	.	.	.	.	.	.	.		.	.
08/21/85	.		7	.	.	.	.	.	.	.	.		.	.	.
08/24/85	.	.			.	.	.	.	.	.	4	.		.	
08/25/85	.				.	.	.	.	.		4	.	.	.	.
09/12/85	.	.	.	.	3	.	.	.	.	.	.		.	.	.
BLACKFISH															
08/24/85	.	s	.			.	.	.	.	.	7	.	.	.	.
08/30/85	.		.		.	.	.	.	.		.		.	.	27

APPENDIX B

Table 2. Catch Per 24-Hour Single Fyke Net Set

DATE	4-1	4-2	4-4	4-5	4-6	7-1	7-6	8-1	B-2	9-1	9-2	10-3	11-2	12-1	13-1
STATION															
STARRY FLOUNDER															
06/27/85	26	.		.	.	.				.			.	.	.
07/01/85	.	11	.		.	.	.	.	.	.		.		.	.
0712412S	.		190	.		.	.	.	.	.		.	.	.	.
07/30/85	.			50	.	.	.	.		.		.		.	.
08/04/85	12				.	.	.	.	.	.	.	.	.	.	.
08/05/85	4			.	.	.	.	.			.		.	.	
08/07/85	.	.			26	.	.			.	.			.	
08/08/85	.	.	.		15	.					.	.	.	.	.
08/20/85	.	.	8	.	.	.	.	.						.	.
08/21/85	.	.	44			.	.	.	.	.		.	.	.	.
08/28/85	.	.	21	.		.	.	.		.			.		.
28/12/25	.			.	2	.	.			.	.	.	.	.	.
29/17/25	.		.	5	.	.	.	.	.	.		.	.	.	.
ARCTIC FLOUNDER															
06/27/85	07	.												.	.
07/91/25	.	1	.	.	.		.	.		.			.	.	.
07/24/85	.		108	.	.		.	.	.			.	.	.	.
07/30/85		.	.	132	.	.	.	.	.	.	.	.	.	.	.
08/04/85	2	.	.		.	.	.	.		.	.	.	.	.	.
08/07/85			.	.	2		.				.	.		.	
08/08/85			.		5									.	
08/20/85	.	.	11	.	.	.	.	.	.	.		.	.	.	.
00/21/25		.	74	.	.	.	.	.	.					.	.
08/28/85	.		4	.	.	.	.	.	.	.	.	.	.	.	.
09/16/2S	4				.	.	.	.	.	.		.	.	.	.
09/17/85		.	.	14		.	.	.		.	.		.	.	
SAFFRON COD															
06/27/85	1	.		.		.	.				.	.	.	.	.
08/07/85	.	.	.		3	.	.	.		.		.	.	.	.
08/21/85	.		3	.	.	.	.	.	.	.		.	.	.	.
09/12/85	.	.	.	.	219	.	.	.	.	.	.			.	.
09/16/85	1		.		.	.	.	.	.	.	.	.	.	.	.
09/ 17/25	.	.	.	71	.	.	.	.		.	.	.	.	.	.
FOURHORN SCULPIN															
02/12/25	.	.		.	1	.	.				.	.	.	.	.

APPENDIX B

Table 3. Catch Per 24-Hour Double Fyke Net Set

DATE	STATION 3-1	3-2	3-3	3-5	3-6
CHINOOK SALMON					
06/25/85	4				•
JUVENILE CHUM SALMON					
06/25/2s	128		•	•	•
PINK SALMON					
06/25/85	16	.	•		
SHEEFISH					
89/84/2s	.	.	•	•	21
08/14/85	.		32	•	
08/19/85	.		.	70	
2?2112/25	.		30	,	
HUMPBACK WHITEFISH					
06/25/85	11		.		
29/12/2s	•	.	3		•
UNIDENTIFIED WHITEFISH					
22/04/25	.	.			1
08/14/85	.	.	17	.	•
08/19/85	.	.		2	•
09/12/85	.	.	15	.	•
BERING CISCO					
08/04/85	.	•	•		3
09/12/85	.	•	1	.	.
LEAST CISCO					
06/25/85	7	•	•	•	•
08/14/85	.	•	3	•	•
09/12/85	.	.	3		•
UNIDENTIFIED CISCO					
08/04/85	.	•	•	•	10
08/ 14/85	.	•	26		.
08/19/85	.		.	3	.
09/12/85	.	.	14	.	
BOREAL SMELT					
06/25/85	49		•	•	•
08/04/85	.	•		•	273
08/14/85	.	•	3		.
08/19/85	.	.	.	2	.

APPENDIX B

Table 3. Catch Per 24-Hour Double Fyke Net Set

		STATION			
Cm-2	3-1	3-2	3-3	3-5	3-6
POND SMELT					
02/04/05	,				18
22/14/05	.		3	•	.
82/19/05	.		.	5	
09/12/25	.	.	3		.
UNIDENTIFIED SMELT					
08/04/85	.			.	103
02/14/25	∘	.	74	.	.
NINESPINE STICKLEBACK					
08/04/85	.			.	2
08/14/85	.	.	36	.	.
08/19/85	.			1	
09/12/85	.	.	2		
ARCTIC LAMPREY					
06/23/0s	2				
BURBOT					
08/04/85	.	.		.	1
23/14/25	.	.	53	.	
08/19/85	.	.	.	9	.
09/12/2s	,	.	9		
STARRY FLOUNDER					
06/25/85	1				.
06/04/2s	,			.	6
08/ 14/85	.		2		
09/12/85	.		1	.	
ARCTIC FLOUNDER					
08/04/85	.				369
08/14/85	.	.	6	.	
08/19/85	.			210	.
SAFFRON MD					
06/25/85	3				
08/04/85	.			.	1
82/14/25	.	.	20	.	
08/19/85	.			4	.
%9112125	.	.	68		
FOURHORN SCULPIN					
08/04/85	.				2s
68/14/25	.	.	12	.	.
08/19/85	.	.	.	6a	.
UNIDENTIFIED SCULPIN					
07/01/85	.	0			•
08/04/85	.		.		7

APPENDIX B

Table 4. Catch Per 10-Minute **Purse Seine Set**

DATE	i-l	1-2	1-3	STATION 2-1	2-2	2-3	6-1	6-2	6-3
CHINOOK SALMON									
06/14/85	.		.				1		
06/16/25	.	.	.	1					
06/17/85	.		.	1			0		
06/25/85					2				2
06/30/85	,	.	.	1				•	.
07/10/85	.	.		1	.	•			
07/25/85	.		.			•			1
JUVENILE CHUM SALMON									
26117/25	.	.	.	3	.	•	5		
06/19/85	.		.	.		•		12	•
2%/21/25	1		.	.			.	.	•
06/25/85	.		.	.	19				46
06/30/85	.	.	.	136		•	.		.
07/04/85	.	.		•			3		
07/15/85	.	.	.				1		
07/17/85	.			•			2		
07 /21/85	.		.					1	
07 /25/85	.	.	.	•		•			1
07 /26/85	.	1	.		i	•	.	.	.
08/10/85	.		0	0	.	•	1		
08/12/85	.		.			•		1	.
09/10/85	.	0	.	.	.				1
ADULT CHUM SALMON									
06/17/85	.	.		1		•	e	.	
07/21/85	.			.			.	1	•
ADULT COHO SALMON									
08/12/85	.	.		•		•	.	1	•
PINK SALMON									
06/14/85	.	.	.	•		•	2	.	
06/16/85	.			1			.		•
06/17/85	.	.		1	.	•	5		•
06/19/85	.		.	.	.	•	.	2	•
06/21/85	6	.	.	.					
07/10/85	.		.	1	.	•	.	.	•
07/21/85	.	.			.		.	2	•
07/26/85	.	1	.		e	•	.		•
UNIDENTIFIED DOLLY VARDEN/ARCTIC CHAR									
07/22/85	0	•	•	•	.	1			
SHEEFISH									
27/15125	.	•		•		•	4	•	•
07/17/85	,		•			.	19	.	,
07/18/85	.	•	•	49		.		.	•
07/21/85	,	•	•	•	.			27	•
07/22/85	e	•	•	•		3	.	.	.

APPENDIX B

Table 4. Catch Per 10-Minute Purse Seine Set

DATE	STATION 1-1	1-2	1-3	2-1	2-2	2-3	6-1	6-2	6-3
SHEEFISH									
07/25/85	.	.	.				.		27
07/26/85	.	1	.		I	.		.	.
08/10/85	.	.	0	1			3		.
08/11/85	,				2	.	.	.	5
08/12/85	.						.	10	.
08/14/85	.						.	4	e
08/15/85	.					.	2		
0S/16/2S	.		0	2			.		
HUMPBACK WHITEFISH									
08/12/85	.	.			.	.		1	.
09/13/85	.							1	.
BROAD WHITEFISH									
08/12/85	.							1	.
UNIDENTIFIED WHITEFISH									
07 /04/85	.		.		.		2	.	.
07/21/85	.		.	.	.	.	.	1	.
07/25/85	.					.	.		31
08/10/85	.		0	0			1	.	.
08/11/85	.		.		1				0
08/12/85	.		.					5 5	.
08/14/85	,	.			.			28	0
08/16/85	.		e	1					.
09/13/85	.	.		.				7	.
LEAST CISCO									
07/21/85	.							1	.
08/16/85	.	.	e	1	.	.	.		.
09/13/85	.	.			.	.		1	.
UNIDENTIFIED CISCO									
07/25/ss	.	.	.	.	.		.		17
07/26/85	.	34	.	.	2	.	.	.	.
08/10/85	.	.	36	1		.	2	.	.
08/11/85	.		.		1		.	.	1
08/12/85		.	.		.	.	.	9	.
08/13/85	10	.						.	.
08/ 14/85	.	.	.		.	.	.	12	e
09/04/85	.	.	0	1				.	.
09/05/85	.				.	.	3	.	.
09/10/85	.	3	.	.	.	.	.		e
09/13/85	.		.		.	.		6	.
UNIDENTIFIED CISCO AND WHITEFISH									
07/15/25	.	.	.	.	.	.	3s.		.
07/17/85	.	.	.	.			76	.	.
07/18/85	.	.	.	77	.		.		.
071211S5	.	.		.	.	.	.	102	.
07/22/85	1	.		.		60	.	.	.

APPENDIX B

Table 4. Catch **Per 10-Minute Purse** Seine Set

DATE	1-1	I-2	1-3	2-1	2-2	2-3	6-1	6-2	6-3
				STATION					
BOREAL SMELT									
06/14/85	.	.		.	.	.	7		
06/16/85	.	.		4	.			.	.
06/17/85	.			2	.	.	0	.	
06/21/85	93s	.		.	.			.	.
06	.	.		.	0			.	1
87/19/s5	.		50		.		.		
07/22/85	8	.		.	.	243		.	
07/26/85	.	4	.		e		.	.	.
08/10/85	.	.	380	0	.		0	.	
08/11/85	.	.			1		.	.	2
0s/13/s5	54	.		.	.	.			,
0s/16/ss	.	.	361	0			.	.	
09/04/85	.		61	e	.			.	
09/10/05		24	.			.			0
POND SMELT									
0s/10/ss	.	.	116	0			4	.	.
08/12/85			.	.		.	.	11	.
0S/13/s5	13	,			.				
08/14/85				.		.	.	3	0
08/16/85		.	6	2			.	.	.
99/s4/s5			51	0	.	.			
09/10/85	.	97	.				.		0
09/13/85			.	.	.	.	.	1	
UNIDENTIFIED SMELT									
07/22/85	0			.	.	91			
08/10/85	.	.	0	1	.		2	.	
08/11/85	.		.		0		.		1
08/15/85	.	.	.	.	.	.	1		
02/16/S5	.		0	1	.	.	.		
NINESPINE STICKLEBACK									
06/30/85	,		.	1	.				.
07/10/85	.		.	1	.	.	.		
07/22/85	12s			.	.	8	.		.
07/26/85	.	6	.	.	0	.	.	.	
08/10/85	,		66	2	.	.	0		.
08/12/85	.	.	.		.		.	2	
08/13/s5	i		.	.	.	.			
08/16/85	.	.	5	7	.	.		.	
09/04/85	.		5	76	.	.	.		
09/10/85	.	25	.	.	.	.	.	.	0
09/13/85	.		.		.		.	1	

APPENDIX B

Table 4. Catch **Per 10-Minute Purse** Seine Set

DATE	1-1	1-2	1-3	2-i	2-2	2-3	6-1	6-2	6-3
ARCTIC LAMPREY									
06/14/85	.		.		.	.	1	.	.
06/17/85	.	.	.	1	.	.	0	.	.
06/25/85	.	.			0	.	.	.	1
07/84/s5	.	.			.		1	.	.
07/22/85	1	.		.		0	.	.	.
LONGNOSE SUCKER									
09/12/ss	.							1	.
NORTHERN PIKE									
08/12/85	.		.	.			.	1	
BURBOT									
07/15/85	.	.				.	2	.	.
07/ 17/85	.						2	.	.
07/21/85	,				.	.		2	.
08/11/85	.			.	0	.		.	1
08/12/85	.			.		.	.	1	.
08/14/85	.	.		.			.	1	0
09/05/85	.				.		1	.	.
09/13/85	.	.					.	5	.
STARRY FLOUNDER									
06/25/85	.	.			1	.	.	.	e
07/22/85	0		.		,	1	.	.	
0S/16/S5	.		e	1,	.		.	.	.
09/04/85	.	.	0	1	.	.	.	.	
ARCTIC FLOUNDER									
06/30/85	.	.		1			.		
07/ 18/85	.			1					
27/?2/2s	0	.	.		.	6		.	
07/26/85	.	e		.	1				
08/10/85	.	.	2	5	.		0		.
08/11/85	.		.	.	6		.		0
08/16/85	.		6	1	.				
09/04/85	.		e	7					.
89/89/s5	.		.	.	1	.	.		
SAFFRON COD									
07/22/85	3				.	1	.	.	
07/26125	.	2	.		e	.	.	.	.
28/10/25	.	.	119	0	.	.	e	.	.
86{13/65	33	.	.		.	.	.	.	.
2s/16/25	.	.	138	8	.	.	.	.	.
09/04/85	.	.	167	e.	.		.	.	
09/10/85	,	53				.	.		e

APPENDIX B

Table 4. Catch Per 10-Minute Purse Seine Set

DATE	STATION 1-1	1-2	1-3	2-1	2-2	2-3	6-1	6-2	6-3
ARCTIC COD									
08/14/85	.		.				.	0	0
09/10/85	.	1				.			0
FOURHORN SCULPIN									
06/25/85	.		.	.	1	.	.	.	0
08/10/85	.		1	0			0	.	
08/11/85	.	.		.	2	.	.	.	0
09/16/85	.	.	1	1				.	
09/04/85	.		0	"8		.	.	.	
09/09/85	.			.	2	.	.	.	.
PACIFIC HERRING									
06/21/85	1			.		.	.		
07/19/85	.	.	3 9	.		.	.	.	
07/22/85	4					0			.
97/26/2s	.	100	.	.	e				.
08/10/85	.	.	4	0			0		
08/13/85	4			.		.		.	.
08/16/85	.	.	2	0					
09/04/85	.		19	0	.	.	.		.
29/10/25	.	1	.	.		.	.	.	0
CAPELIN									
07/19/2s	.	.	3	.	.	.			
BERING POACHERS									
08/16/85	.	.	1	0				.	
CKLEBACKS									
08/10/85	.	.	1	0		.	'	a .	.
00/16/2S	.	.	2	0	.	.		#	.
WHITESPOTTED GREENLING									
08/10/85	.	.	3	e			0	.	.

APPENDIX B

Table 5. Catch Per 10-Minute Hook Seine Set

DATE	7-2	7-3	7-4	STATION 7-5	7-7	7-8	7-9	7-10
CHINOOK SALMON								
06/28/85	.		•		0	1		
JUVENILE CHUM SALMON								
06/20/85	'a	13	•		•		•	
06/22/85	.	.	31					
06/26/25	.		.	3				
06/28/85	•				1	125		•
07/02/85	•					16		
07/07/85	•		.	.		10		
07/09/85	.	,	.	.		6		
07/12/85	.	.	,			5	1	
07/22/85	.	1	.			•	•	
08/02/85	,	1	.	.	•	•		0
08/15/85	.					1		
08/30/85	.	.	.			1	•	•
09/13/85	1	.	.					
JUVENILE COHO SALMON								
07/25/85	.						•	1
PINK SALMON								
06/20/85	1	14	.	•	•	•	•	•
06122185	.	.	a		•			•
06/26/25	.	.	.	1	.	.	.	.
06/28/85	.			.	0	.	%	. .
08/02/85	.	1		.		.	.	0
$2/03/25	0	.		.	.	.		.
UNIDENTIFIED MIXED PINK AND CHUM								
06/20/85	e	128	.		•		•	
06/26/85	.	.	.	1	.	.	.	.
SHEEFISH								
06/20/85	2	0		•	•	•		
06/26/85	.	.	.	1	•	•	•	
06128125	.	.	.		0	2	•	•
07/02/85	.	.	.	.		1	•	•
07/87/0S	.	.	.	.	.	17	.	•
07/09/85	.	.	.		.	2	7 .	
07/12/05	.	.	.	.	.	28	16	•
07/17/85	•	•	.	.	.	17	.	•
07/21/85	2	.	0	.	•	•	•	•
08/01/85	.	.	.	.		4	•	•
08/07/85	.	.	.			1	.	•
08/12/85	1	.			•	•	•	
08/ 15/85	.	.		.	•	2	.	
08/30/85	.	.	.	.		1	•	•
09/13/25	2	.		.	•	•	•	

APPENDIX B

Table 5. Catch Per 10-Minute Hook Seine Set

DATE	STATION 7-2	7-3	7-4	7-5	7-7	7-8	7-9	7-10
HUMPBACK WHITEFISH								
06/20/85	4	1	.	.	.	.	.	.
06/26/85	.	.	.	2	.			.
07/21/85	2	.	0		.			.
07/25/65	.						.	3
08/01/85	.				.	1		.
08/02/85	.	1	.			.	.	2
08/03/85	0				.	.	.	
08/06/85	.	.			.	.	2	
08/12/85	2	.			.	.	.	.
BROAD WHITEFISH								
06/20/85	0	1	.		.	.	.	
06/26/85	.	.	.	1	.			.
06/28/85	.	.	.		0	1	.	.
07/02/85	.				.	1	.	.
07/22/85	.	1			.			.
UNIDENTIFIED WHITEFISH								
06/28/85	.			.	0	5	.	.
07/02/85	.		.	.	.	2 9	.	.
87/21/ss	2	.	0		.			.
07/22/2s		1		.			.	
07/25/85	.	.	.	.		.	.	24
08/01/85	.	.			.	51	.	.
08/02/85		37	.	.	.	.	.	11
08/03/85	6	.	.			.		
06/06/6s		.	.	.			2 2	.
08/07/85	.		.	.		1	.	.
0s/12/ss	9	,	.		.			
0s/15/ss	.	.		.		2	.	.
08/30/85	.	.				2	.	.
BERING CISCO								
06/26/85	.	.		1		.	.	.
LEAST CISCO								
06/20/85	1	0	.	.	.	.	.	.
06/26/85		.	.	2	.	.	.	
06/28/85	.	.	.	.	1	1	.	.
07/09/s5		.	.		.	4		
07/12/25	.	.	.	.	.	0	1	.
07/21/85	4	.	0	.		.		
08/03/85	1	.	.				.	
09/13/s5	4					.	.	.

APPENDIX B

Table 5. Catch Per 10-Minute Hook Seine Set

DATE	7-2	7-3	7-4	7-5	7-7	1-8	7-9	7-i's
				STATION				
UNIDENTIFIED CISCO								
07/25/85	.	.	.	.	.	.		15
02/01/25	.	.		.		2		.
08/02/85	.	9						2
08/03/85	3	.	.		.			
08/06/85	.	.		.	.	.	2	
08/07/85	.	.		.	.	1	.	
08/15/85	.	.		.	.	1		.
08/22/85	.	.				2		
02/30/85	.	.		.		12		
09/13/s5	14	.	.					
UNIDENTIFIED CISCO AND WHITEFISH								
06/28/85	.				1	0	.	.
07/07/85						148	.	.
07/09/85	.					13	.	.
07/12/85		.		.	,	136	199	.
07/17/85	.					121	.	.
07/21035	19-2		0		.	.		
97/22/25	.	49			.			
BOREAL SMELT								
06/20/85	1	0		.	.	.		.
06/26/85				15	.			
08/02/85	.	1					.	0
02/(36/s5					.	.	1	.
POND SMELT								
07/02/85		,				1	.	
07/21/85	0	.	'a			'		
07/25/85		.	.	.	.	'		1
08/01/85	.					1	.	
28/15/s5						1		
08/30/85				.	.	3		
99/13/25	32	.	.		.			
UNIDENTIFIED SMELT								
07/21/85	0		0	.	.	.	.	
07/31/2s	.					0	.	
08/02/85	.	70						0
08/03/85	582		.		.		.	.
08/06/85	.	.	.	.			1	
02107125	.	.			.	1		
08/12/85	272				.			
02/15/s5	.	.	.		.	6		.
08/22/85	.		.		.	1		.
08/30/85	.	.				13		

APPENDIX B

Table 5. Catch Per 10-Minute Hook Seine Set

DATE	7-2	7-3	7-4	7-5	7-1	7-8	7-9	7-10
NINESPINE STICKLEBACK								
06/20/85	7	0				•		
07/21/85	7		e	•	•	•	•	•
0S/s2/ss	.	1				•	•	1
08/03/85	14	.	.		•	.	.	.
08/06/85	.		,	•	•	.	1	.
08/07/85	.	.	.		•	1	•	•
08/12/85	10		.			.	.	.
0s/15/s5	.	.	.		•	1	•	•
08/30/85	.	.	.	•	•	1	.	.
09/13/s5	14	.	.	•	•	.		
ARCTIC LAMPREY								
06/20/85	2	3	.			•		
06/22/85	.		2	•			•	•
06/28/85	.	.	.	•	0	2		•
07/02/85	.	.	.		.	4		•
UNIDENTIFIED LAMPREY								
07/09/85	.		.			3	•	•
07/12/85	.		.			5	1	•
07/17/85	.	.	.	•	,	1		•
08/01/85	.	.	.	•		1		
8S/06/8s	.						9	•
0s/15/ss	.	.	.	•	.	1	.	
08/30/85	.	.	.			1		
09/10/85	.		.	•	.	1	.	•
LONGNOSE SUCKER								
06/28/85	•		•	•	1	0	•	•
07/07/85	•		•	•	•	1	•	•
07/12/85		•	•	•	•	0	1	•
07/22/85	•	1		•			.	•
28/82/s5	•	1		•	•		.	1
08/06/85		•			•	•	3	•
08/07/85	•		•	•	•	1	.	•
08/ 12/25	2	•			•	•		•
NORTHERN PIKE								
06/28/85	.	•			1	0		
07/12/85	.	•	•	•		0	1	•
07/25/85	.	•	•		.			2
08/06/85	.	•	•	•		•	1	•
08/07/85	.	•	•	•	.	3	.	•
08/15/85	.	•	•	•		1	.	•

APPENDIX B

Table 5. Catch Per 10-Minute Hook Seine Set

DATE	STATION 7-2	7-3	7-4	7-5	7-1	7-8	7-9	7-10
BURBOT								
06/20/85	1	0	.		.		.	
06120125					1	0		.
07/07/85	.				.	16	.	
07109/ss				.	.	2	.	.
07/12/85			.		.	42	146	
07/17/85			.	.	.	%	,	.
07/21/S5	12		0					
07/22/85		54	.	.	.	.	.	
07125125					.		.	Z?
08/01/85					.	9		.
08/02/85		30	.	.	.			25
08/03/85	3				.	.		
0S/86/2s		.			.		16	
08/07/85	.	.		.	.	3		.
00112/s5	1	.		.	.		.	.
08/15/85	.			. .	.	2		.
08/22/85				.		1		.
09/13/85	2	.		.				.
09/18/25	.	.	.	.	.	1		
BLACKFISH								
06/20/85	1	'a		.	.	.		
TROUT-PERCH								
06/28/85	.	.	.	.	0	1		.
STARRY FLOUNDER								
06/20/85	3	0		.	.	.		.
07/21/85	2	.	i	.	.	.	.	.
08/03/85	1	.		.	.	.		.
ARCTIC FLOUNDER								
08/12/85	1		.	.	.	.	.	.
FOURHORN SCULPIN								
08/02/85	.	0	.	.	.	.	.	1

APPENDIX B

Table 6. Catch Per 24-Hour Lake Outlet Trap Set

	STATION					
DATE	10-1 DOWN	la-l UP	16-2 DOWN	la-2 UP	10-3 DOWN	1 e-3 UP
CHUM SALMON						
S61271SS	.		.		35	1
07/63/s5	0	0		.	.	
07/05/85	0	0	.			.
07/06/85	1	'a		.	.	
SHEEFISH						
07/03/85	1	2			.	
07/05/85	47	22	.	.	.	.
07/06/85	12	19	.	.	.	.
07/%9/ss	37	41	.			.
07/14/85	13	14	.	.	.	.
07/16/s5	11	11	s			.
07/23/65	3	1	,		.	.
87/29/85	1	1	.	.		.
08/01/85	1	1	.	.		.
BROAD WHITEFISH						
82/26/25	.	,	0	1		.
UNIDENTIFIED WHITEFISH						
06/30/s5	0	0	.		.	.
07/23/85	46	33	,			.
07/29/85	64	8		.	.	.
08/01/85	76	13	.		.	.
02/87/s5	13	2	.		.	
08/18/85	2	0	.		,	.
0s/22/2s	0	0	.	.	.	
92/25/s5	.		13	8		.
08/26/85	,	.	12	15	.	
08/29/85	2	1	.	.	.	.
09/08/85	0	0		.	.	
LEAST CISCO						
06/27/85	.		.		15	1
08/26/85	.	.	0	1	.	
UNIDENTIFIED CISCO						
07/23/SS	0	i	.			.
07/29/85	1	10		.		.
08/01/85	12	5	.		.	.
08/07/85	1	0			.	.
02/18/s5	0	0	.		.	.
08/22/85	1	0	.	.		.
08/25/85	.	.	13	4	.	.
08/26/85	.	.	36	6		.
08/29/85	1	0	.		.	.
09/08/85	0	0	.			.

APPENDIX B

Table 6. Catch **Per 24-Hour Lake Outlet Trap Set**

DATE	10-1 DOWN	10-1 UP	10-2 DOWN	10-2 UP	19-3 DOWN	10-3 UP
			STATION			
UNIDENTIFIED CISCO AND WHITEFISH						
07/03/85	2	4	•	•	•	•
07/05/85	331	29	•	•		•
07/06/85	111	20		•	•	•
07/09/85	54	3s	•			•
07/14/85	116	46	•	•	•	•
07/ 16/s5	157	105				
NINESPINE STICKLEBACK						
07/23/85	0	0				
08/22/85	1	0	•			•
08/25/85	,		2	0		
08/26/85	.		105	39	•	•
09/08/85	0	0				•
LONGNOSE SUCKER						
06 /27/85					0	1
07/14/85	0	0		•	•	
08/18/85	0	0	•			•
08/25/85			1	1	•	•
NORTHERN PIKE						
07/05/85	‘a	0				•
07/06/85	3	0		•	•	•
07/09/85	1	0		•		•
87/23/85	0	0		•	•	•
08/01/85	4	1			•	•
02/87/65	‘3	0		•		•
08/12/85	1	0				•
08/18/85	0	0		•	•	•
08/22/85	1	1				•
BURBOT						
07/14/85	0	0				•
07/16/85	1	0	•	•	•	•
07/23/85	0	0		•	•	•
07/29/85	0	1	•	•		•
08/01/85	0	1		•		•
08/07/85	0	0		•	•	•
02/12/05	‘a	2		•	•	•
02/10/ss	0	2		•		•
02/22/s5	3	0		•	•	•
08/25/85			1	5		•
62/26/2s	.		3	i		•
08/29/85	1	0	.			•
BLACKFISH						
06/27/85	.			•	e	3
07/03/85	0	0				.
07/29/85	‘a	‘a	•			.
08/07/85	‘a	0	•			.
08/12185	1	4	•			
08/18/85	1	3	•	•	•	.
08/22/85	1	1	•	•	•	.
08/29/85	0	0	•		•	
09/08/85	e	0	•	•		.
TROUT-PERCH						
07/06/85	9	0		•	•	•

APPENDIX B

Table 7. Catch Per 50-Meter Beach Seine Haul

DATE	STATION 5-1	5-4	5-5	5-9	5-14
JUVENILE CHUM SALMON					
06123185	.	0	1		
PINK SALMON					
06/14/85	2		.	.	.
06/15/85	.	.			0
06/23/85	.	'a	1	.	
SHEEFISH					
06/14/85	5	.			
HUMPBACK WHITEFISH					
06/14/85	34			.	.
06/23/85	.	37	7		.
07/08/85	.	.		1	
BROAD WHITEFISH					
06/14/85	6				.
07/08/85	.			1	
BERING CISCO					
06/14/05	1	.			
LEAST CISCO					
06/14/85	4	.	.	.	.
06/23/85	.	3	3	.	.
07/92/25	.	.	.	1	.
UNIDENTIFIED CISCO AND WHITEFISH					
07/08/85	.	.	.	141	.
NINESPINE STICKLEBACK					
06/14/85	1			.	.
06/15/25	.	a	.	.	'a
06/23/85	.	0	1		.
ARCTIC LAMPREY					
06/15/85	.	.	.		1
LONGNOSE SUCKER					
06/14/05	1	.		.	.
07/08/85	.		.	1	.
BURBOT					
06/15/2s	.				1
26/23/2S	.	4	0	.	.
07/08/85	,	.		8	
STARRY FLOUNDER					
06/23/85	.	0	2	.	

APPENDIX B

Table 8. Catch Per 24-Hour Tidal Net Set

	STATION												
DATE	S-1 DOWN	S-6 DOWN	S-7 DOWN	S-8 DOWN	S-8 UP	S-10 DOWN	S-10 UP	S-11 DOWN	S-11 UP	S-12 DOWN	S-12 UP	S-13 DOWN	S-13 UP
JUVENILE CHUM SALMON													
07/09/85	.	.	.	0	2	.	.	.	.	.	.	.	.
07/11/85	.	.	.	0	8	.	.	.	.	.	.	.	.
08/05/85	,	.	.	.	.	.	.	.	.	0	1	.	.
ADULT CHUM SALMON													
27/11/2s	.	.	.	0	1	.		.	.		.	.	.
UNIDENTIFIED MIXED PIN% AND CHUM													
06/23/85	.	51	.			.	.			.		.	.
SHEEFISH													
06/14/85	4		.		.	.	.	.			.		
07/09/85	.	.		15	3	.	.	.	.	.			
07/11/85	.			7	5	.		.		.	.		
07/24/85	.	.	.			36	4	.	.			.	
07/30/85	.	.		.	.	.		97	9	.	.	.	
08/04/85	.	.	.		.	.	.	.		4	5		
08/05/85	.	.	.	.		.		.	.	1	7		.
08/07/85	.	.	.	.	.		.		.			2	0
08/08/85	.	.	.			.	.	.	.	.		2	0
08/20/85	.		.	.	.	58	a	.			.	.	
09/12/85	.		.			.	.		.	.	.	i	0
09/16/85	.		.	.		.	.	.	.	112	70	.	.
HUMPBACK WHITEFISH													
06/14/85	16		.		.		.			.	.	.	
06/21/85	.		629				.	.	.	.	.	.	
26/23/2S	.	191		.	.			.	.	.	.	.	
07/09/85	.	.	.	9	2	.	.	.	.	.	.	.	.
07/11/85	.	.		1	0	.	.	.	.	.		.	.
07 /24/85	.	.	.			3	0	.	.	.			
07/30/85	.	.		.	.	.		1	0	.	.	.	.
08/04/85	.	.	.			.	.		.	1	3	.	
08/05/85	.	.	.	.		.	.	.	.	7	4	.	.
08/07/85	.	.	.	.	.	.	.		.	.	.	a	4
08/08/85	.	.	.	.		.	.	.	.	.		14	6
08/20/85	.	.	.	.	.	82	13	.		.	.	.	
29/12/25	.	.	.			.	.	.	.	.		1	1
29/16/2S	.	.	.	.	.	.	.	.		10	16	.	
BROAD WHITEFISH													
06/21/85	.	.	2a		.		.			.	.	.	.
07/09/85	.			0	2	.	.	.	.		.	.	
08/04/85	.		.	.	.	.	.	.		1	0	.	.
08/05/85	.		.	.	.	.	.	.	.	a	1	.	.
08/08/85	.			.		.	.	.	.	.	.	1	2
69/12/25	.	.	.			.	.	.	.	.		0	2
09/17/85	.	.		.	.	.	.	0	30	.	.	.	.

APPENDIX B

Table 8. Catch Per 24-Hour Tidal Net Set

	STATION												
DATE	5-1 DOWN	5-6 DOWN	5-7 DOWN	5-a DOWN	5-8 UP	5-10 DOWN	5-10 UP	5-11 DOWN	5-11 W	S-12 DOWN	5-12 w	5-13 DOWN	5-13 UP
ROUND WHITEFISH													
06/23/85	.	4		.		.	.			.	.		
UNIDENTIFIED WHITEFISH													
07/24/85		,	,	.	.	212	497		.				.
87/30/85		.	.			,	.	1050	102		.		
08/04/85			.		.		.		.	94	132		
08/05/85	.	,	.	.	.	.	.			100	243		.
08/07/85		.		.		.	.	.	.	,	.	81	36
90/00/25	.		#		.		.		.		.	41	112
08/20/85	.	.			.	100	24	.		.			
08/28/85	.	.	.		,	109	43				.	.	.
09/12/25				.	.					.	.	1	20
09/16/85	.		.	.		.	.	,	.	31	101		.
09/17/25	.		.		.	.	.	0	13	.			.
ARCTIC CISCO													
06/21/85	.	.	3	.	.	,	.			.			
BERING CISCO													
06/14/85	1		.	.	.			.	.			.	
07/39/$5		.		.			.	1	0	.			
08/04/85		.				.	.		.	0	1		.
08/05/85	.	.	.	.	.		.			0	1		
0s/07/25	.	.		.						.		3	0
82/28125	.	.	.	.	.	5	0	.			.		
09/12/85	.	.		.	.		.			.		3	1
LEAST CISCO													
06/14/85	18		.	.	.	.					.		.
06/21/85	,	.	444	.	.	.		.	.	.		.	.
66/23/25	.	136			.	.			.	.		.	.
07/09/85		.		8	3	.		.			.	.	
07/11/85	.	.		1	1	.	.	.	.	.			.
07/24/85	.	.	.	.	.	9	9	.		.	.		
	.	.	.	.	.		.	3	0	.	.	.	
08/04/85	.	.	.		.	.	.		.	1	1		
08/05/85	.	.	.	.	,			.		i	10		
$9/07/25	.		.		.	.	.	.	.	.	.	6	2
08/08/85	r	.	.	.	.	.	.			.	.	3	2
08/20/85		.		,		2	0	.	.	.	.	.	
02/20/25	.		.			11	3		.	.	.		.
09/12/85	.	.	.	.	.			.		.	.	13	1
09/16/85		.		.		.	.	.	.	4	i	.	.
09/17/85	.	.	.		.			0	i	.	.	.	.

APPENDIX B

Table 8. Catch Per 24-Hour Tidal Net Set

	STATION													
DATE	s-1 DOWN	5-6 DOWN	5-7 DOWN	5-8 DOWN	5-a w	5-10 DOWN	5-10 UP	S-11 DOWN	5-11 w	5-12 DOWN	5-12 w	5-13 DOWN	5-13 UP
UNIDENTIFIED CISCO														
67124185	.	•			•	45	48				•		
07/33/2s	.			•			.	798	112	•	•		•
08/04/85	a		•		•	.	.		.	41	4		
08/05/85	.	•	•		•		. •	.		7	42	•	•
08/07/85	.		•		•			.			.	2	6
08/08/85	.		•	•	•	.		.		,	.	2	3
08/20/85	.				•	12	a	.	.	.	.		.
08/28/85	.					98	13a		.		.		.
09/12/85	.		•	•	•			.			.	9	1
09/16/85	.		•	•		.				38	75	.	.
09/17/s5	.	•			•			0	4	,		.	
UNIDENTIFIED CISCO AND WHITEFISH														
07/09/85	.			94	251	.			.				
07/11/85	.	•		37	107	.		.			.		
BOREAL SMELT														
06/21/85	.		26			.	.		.		.	•	
96/23[85	.	4			.		.	.			.		
08/04/85	.					.	.			2	‘a		
POND SMELT														
06/21/2s	.	.	53		.								
09/17/25	.	.		.	.			0	1	.		•	•
THREESPINE STICKLEBACK										o			
07/24/85	.		.		.	1	0		.		.		
NINESPINE STICKLEBACK														
6/21/s5	.		579									•	
86123125	.	23		.						.		•	
07/24/85	.			.		10	0	.		.	.	•	•
07/ 30/85	.	.			.	.		244	7	.	.	•	
08/05/85	.	.	.		.	.		.		0	4	•	•
08/08/85	.	.	.		.	.	.	.	.	.		1	‘a
08/20/85	.		.			5	0	.		.	.		
08/28/85	.	.				213	17	.	.	.		•	•
09/12/s5	.	.		.		.		.			.	38	47
09/16/S5	.			.	.	.	.		.	13	i		.
09/17/85	.	.	.		.	.		1054	92				•
LONGNOSE SUCKER														
96/21/85	.		579		.				•				
06/23/85	.	23					.		•			•	
07/24/85	.					10	0	.	.	•	•	•	
07/30/85	.							244	7	•	•	•	
08/05/85	.		.	.		.	.	.	•	0	4	•	•
02102{s5	.							.	•	•	.	1	0
08/20/85	.		.	.		5	0		•			•	
08/28/85	.	,	.			213	17			•		•	
09/12/85	.	.						.	•			38	47
$3/16/S5	.		.	.	.	.	.		•	13	1		
09/17/85	.			,	.			1054	92	•			
LONGNOSE SUCKER														
06/21/s5	.	.	17	.	.	.	.	.	•	•	•		•
66/23/s5	.	23					.	,			•		•
07/09/05	.			0	2								•
07/11/85	.	.	.	1	1	.	.		•	•	•		•
07/24/85	.		.	.	.	2	0				•		•
08/07/85	.		.	.	.	.	.	.	•	•	•	18	s
0s/02/s5	.		.	.		.	.	.	.	.	.	12	13

APPENDIX B

Table 8. Catch Per 24-Hour Tidal Net Set

	STATION												
DATE	5-1 DOWN	5-6 DOWN	S-7 DOWN	5-8 DOWN	5-8 W	5-10 DOWN	5-10 UP	5-11 DOWN	5-11 UP	S-12 DOWN	S-12 UP	5-13 DOWN	S-13 UP
08/20/85	.	.	.			1	e	. .	.	,	.		.
NORTHERN PIKE													
07/09/s5	.	.	.	2	8	.	.	.	.	.	.	.	.
08/07/85	.				.		.	.	.	.		8	1
08/08/85	.		.		.		.	.			.	1	8
BURBOT													
6/14/s5	13						.		.	.			.
06/21/85	.		3	.		.	.						
97/s9125	.	.	.	2	3		.	.	.				
07/11/85	.			1	e	.	.	.	.				.
07/24/85	.		.	.	.	2	8		.		.		.
08/05/85	.	.	.			.	.	.	.	8	1	.	.
0s/97/ss	.	.		.		.	.				.	5	1
0s/0s/S5	.	.	.		.		.	.	.	.	.	9	7
08/20/85	.			.		2	2						
08/28/85						6	2						.
89/12/s5	.		.		.	.						2	8
09/16/85	.		.	.						4	6		.
STARRY FLOUNDER													
06/21/85	.	.	30					.		.			
06/23/85	.	8	.				.	.	.	.			
07/24/85	.	.		.		33	7	.		.			
07/30/85	.	.					.	4	0	.			.
08/04/85	.			.	.			.	.	10	2		
08/05/85	.			.		.		.	.	8	2	.	.
08/07/85	.	.	.	.	.	.	.		.	.		1	4
08/08/85	.		.		.	.	.		.			7	4
08/28/85	.	.	.		.	2	3	:			.	.	
99/16/SS	.		.	.	.	.	.	.	.	3	8	.	
S9/17/ss	.	.		.		.		1	0	.			
ARCTIC FLOUNDER													
07/24/85	.	.	.	.		74	9	.				.	
07/30/85	.	.	.	.	.		.	317	6	.	.		
08/04/85	.	.	.	.	.		.			4	e		
08/05/85	.	.	.		.	.	.	.	.	e	1		.
08/20/85	.	.		.	.	5	8	.		.			
08/28/85	.		.		.	26	3	.	.	.	.		.
09/16/85	.	.		.						2	1	.	
09/17/ss	.		.	.	.		.	83	5	.	.		
SAFFRON COD													
06/23/85	.	4	.				.		.	.	.	.	
07/30/85	.				.	.	.	1	0	.			.
08/28/85	.			.	.	25	9!	.	.	.	.	121	227
0s/12/ss	.		.	.		.		.	.				
09/16/85	.	.		.	.	.		.	.	6	9	.	.
09/17/85	.	.				.	.	0	30	.			
FOURHORN WIN													
06/23/SS	.	4		.	.		.	.				1	i
08/08/85	.	.	.	.			.	.		.	.		
09/17/s5	.			.		.		8	1	.	.		

APPENDIX C

LENGTH-FREQUENCY OF CATCH

APPENDIX C

Table 1. Length Frequency of Catch by Habitat and Time Period **for Chinook Salmon**

LENGTH FREQUENCIES OF CATCH
(IN 10MM INTERVALS)

/A FORKLENGTH	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
CHINOOK SALMON													
6/14/SS TO 6/30/85													
70	.	i	.	,	.	,	.	.	.	.	.	.	I
w.	.	.	.	.	.	2	6	.	.	.	.	.	8
90	.	1	.	.	.	.	3	.	.	.	.	.	4
100	,	5	,	.	.	1	.	.	.	.	.	,	6
7116125 TO 7/31/85													
90	.	1	.	.	.	.	.	.	.	.	.	.	1
110	.	1	.	.	.	1	.	.	.	.	.	.	2
0/16/25 TO 8/31 /85													
60	.	.	.	1	.	.	.	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 3S MM)

/A FORKLENGTH	1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
6114/25 TO 9/18/85													
CHINOOK SALMON													
60	.	.	.	14	.	.	.	.	.	.	.	.	1
70	.	1	.	.	.	.	.	.	.	.	.	.	1
243	.	.	.	.	.	2	6,	.	.	.	.	.	8
90	.	2	.	.	.	.	3	.	.	.	.	.	5
100	.	5	.	.	.	1	.	.	.	.	.	.	6
11'2	.	1	.	,	.	1	.	.	.	.	.	.	2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 2. Length Frequency of Catch by Habitat and Time Period for Chum Salmon

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
CHUM SALMON													
6/14/65 TO 6/33/25													
30	.	2	.	.	.	6	27	.	.	.	.	.	35
4a	2	102	47	.	1	7a	216		.	12	.	.	450
5 a	.	39	10	.	.	12	49	.	.	14	.	.	124
w	.		.		.	.	3		.	.	.	.	3
70	.	1	.	.	.	.	.	.	.	.	.	.	1
100	.	1	.	.	.	.	.		.	.	.	.	1
590	.	.	.		1	.	.	.	.	.	.	.	1
6 2 0	.		.		.		1		.	.	.	.	1
6 4 0	.	.			1	.	.	.	.	.	.	.	1
6 6 a	.		.	.	1		.	.	.	.	.	.	1
7/01/85 TO 7/15/85													
30	.		.	.	.	.	6		.	.	.	.	6
40	,	.		.	.	2	44	.		2	.		4a
50	.		.	.	.	1	11	.	.	i	.	.	13
60	.	.		.	1	.	.	.	.	.		.	1
59a	,	.	.	.	1			.	.		.	.	1
660	.	.	.	.	.	.	.	.	.	.	1	.	1
7/16/65 TO 7/31/6S													
4 a	.	.	.	.	.	.	1	.					1
5a	1	.	.		.	1	1	.	.	.	.	.	3
6 a	.	1	.	.	.	1	.	.	.	.	.	.	i?
70	.	.	.	.	.	2	.	.	.	.	.	.	i?
80	.		.	.	.	1		.	.	.	.	.	1
560	.	.	.	.	.	1	.		.	.	.	.	1
600	.	.	.	1	.	.	.	.	.	.	.	.	1
6 5 a	.	.	.	1	.	.	.		.	.	.	.	1
670	.	.	.	1	.	.	.	.	.	.	.	.	1
810	.	.	.	1	.	.	.		.	.	.	.	1
8/01/85 TO 8/15/65													
4 0	.	.	.		.	.	2	.	.	.	.	.	2
50	.	.	.	.	i	2	1	.			.	.	4
70	.	.	.	.	.	.	1		.	.	.	.	1
8/16/85 TO 8/31/85													
50	.	.	.	.	.	.	1		.	.	.	.	1
9/01/85 TO 9/18/85													
50	.	.	.	.	.	1	.	.	.	.	.	.	1
6 a	.	.	.	.	.	.	1	.		.			1

APPENDIX C
Table 2. Chum Salmon (Continued)

FORKLENGTH #a	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/SS													
CHUM SALMON													
30	.	2	.	.	.	6	33	.	.	.		.	41
40	2	102	47	,	1	72	263		.	14	.	.	501
50	1	39	10	.	1	17	63	.	.	15			146
6 0	.	1	.	.	1	1	4	.			.		7
70	.	1	.	.	.	2	1	.					4
w.	.		.	.	.	1	.	.		.		.	1
10s	.	1	.	.	.	.	.	.	.		.		1
56s	.	.	.	.	.	1	.	.	.	.	.		1
590	.	.	.	.	2	.	.	.				.	2
we.	.		.	1	.	.	.	.	.	.	.	.	1
Ea.	.	.		.	.	.	1	.	.			.	1
640	.	.	.	.	1	.	.		.	.	.	.	1
6ss	.	.	.	1	.	.		.	.	.			1
660	.	.	.	.	1	.		.			1		2
670	.	.	.	1	.	.				.		.	1
810	.	.	.	1	.	.	.	.			.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX C

Table 3. Length Frequency of Catch by Habitat and Time Period **for Pink Salmon**

						HABITAT							
FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
PINK SALMON													
6/14/85 TO 6/30/85													
30	10	1	.	.	5	1	34			...,.		,	51
40	1	1	.	.	.	7	9	.	.	.	.	.	18
5 0		.	. .	,	1	2	3			...,		.	6
7/16/85 TO 7/31/6.5													
46	1	.	.	.	.	.	.	.	.	.	.	.	1
60	.	2	.	,	.	1	.	.	.	.	.	.	3
8/01/85 TO 8/15/85													
3 2	,		. .	, .		.	1	.	.	.	.	.	1
#,		...		.		.	1	.	.	.	,	.	1

						HABITAT							
FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/65 TO 9/18/25													
PIN(SALMON													
3a	10	1	.	.	5	1	3s	.	.	.	.	.	52
40	2	1	.	.	.	7	10	.	.	.	.	.	20
xl	.	.	.	.	i	2	3	.	.	.	.	.	6
60	.	2	,	.	.	1	.	.	.	.	.	.	3

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 4. Length Frequency of Catch by Habitat and Time Period for Sheefish

	HABITAT												
FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
SHEEFISH													
6/14/25 TO 6/30/85													
30	.	.	.	.	.	.	2	.	.	.	.	.	2
40	.	.	.	.	.		1	.	.	.			1
2 5 e	.	.	.	.	1		.		.	.		.	1
310	.	.	.	.	.	.	1	.	.	.	.		1
320	.	.	.	.	.	.	1		.			.	i
3 3 0	.	.	.	.	.		1	.	.	.	.	.	1
3 s 2	.	.	.		.	.	1		.		2	.	3
360	.	.	.		2		.	.	.	.	.	.	2
370	.	.	.		1	.			.		2		3
3 2 0	.	.	.	.	1	.	.	.	.	.	.	.	1
390	.		.		2	.	1		.	.	.	.	3
403	.	.	.	.	5	.	.		.	.		.	s
410	,		.		1	.			.	.	.	.	1
420	.			.	1							.	1
430	.		.		1	.			.	.	.	.	1
4 4 0	.	.	.	.	1	.	.	.	.	.			1
450	.		.		1	.		.	.	.	.	.	1
460	.	.	.	.	2	.	.		.			.	2
470	.			.	3	.		.	.	.	2	.	5
4 6 e	.		.		.	.			.	1	2	.	3
510	,			.	.	.	.	.	.		2	.	2
610	,		.		.	.			.		2	.	2
620	.			.	2	.	.		.	.	.		2
630	.	.			.	.		1	.		.	.	1
660	.	.		.	1	.	.	.	.	.	.		1
72e	,		.	.	1	.			.		.	.	1
7/01/85 TO 7/15/85													
10	.	.	.	.	1		.	.		1	.		2
30	.	.		.	1		3		.	3	.		7
40	.		.	.	6	.	45	.	20	es		.	156
50	.	.	.	.	11	2	77	.	31	223	.	.	344
60	.	.	.	.	12	.	31		.	2s		.	66
7e	.	.	.		1	.	3	.	.	1		.	5
140	.	.	.	2	.	.	.	.	.		.	.	2
150	.	.	.	3	.	.	.	.	.	.		,	3
lee	.	.	.	1	,	.			.	.		.	1
190	.	.	.	.	1	.	.		.		.	,	1
250	.	.			1			.	.	,	.		1
2 6 2	.	.	.	2	.	.	.		.		.		2
3 3 2	.			.	1		.	.	.	.	.		1
3 6 e	.	.	.	.	1	.	.		/	.		,	1
380	.			.	.		,	.	/	.	1		1
420	.		.		1	.			.	,	.		1
500	.	.	.	#	1		.	.	.	0	.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 4. Sheefish (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	a	9	10	11	12	TOTAL
SHEEFISH CONT. 7/16/85 TO 7/31/25													
40	.	.		1	.	.	1		.	5	.	.	7
50	.	17	.	4	9	11	9	.	.	31	.		81
60	1	50	.	20	2a	31	9		.	19	.	.	158
70	.	21	.	49	30	37	5	.	.	5	.	.	147
2 0	.	5	.	35	10	26			.	1	.	.	77
90	.	.	.	25	3	9	1	.	.	.	.		3a
100	.	.	.	6		1	.		.	.	.	.	7
110	.	.	.	1	.	.	.	.		.	.	.	1
150	.	.	.	1	.	,	.	.	.	.	.	.	1
170	.	.	.	1	.	.	.	.		.	.	.	1
180	.		.	1		.	.		.	.	.	.	1
190	.	.	.	2	.		1	.	.	.	.	.	3
200	.			1		.	.	.	.	.	.	.	1
210	.	.	.	1	.		.	.	.	.	.	.	1
250	.		.	1		.	.		.	.	.	.	1
2 6 0	.		.	1	.		.	.		.		.	1
290	.		.	2	.	.	.		.	.	.	.	2
300	.	.	.	2	.		.		.	.	.	.	2
3 2 2	.		.	2	.	.	1	.	.	.	.	.	3
360	.	.	.	1	.	.	.			.		.	1
370	.			1	.	.	.	.	.	.	.	.	1
410	.	.	.	1		.	.			.	.	.	1
4 2 0	.		.	1	.	.	.	.	.	.	.	.	1
4 s 0	.	.	.	1		.	.		.	.	.	.	1
8/01/85 TO 8/15/85													
5 a	.		.		3			.	.	.		.	3
60	.	.	!	3	3	.	.	.	.	1	.	.	a
70	.	1	a	23	1	5		.	.	i	.	.	39
2 0	.		12	34	3	6	1	.	.	.		.	56
9 %	.		11	24	3	11	2	.	.	.	.		51
100	.	2	4	4	4	14	3	.	.	.		.	31
110	,	2	2	2	.	5		.	.	.	.		11
130	.	.	.		.	1	.	.	.	.		.	1
200	.	.		i	.	.		.	.	.	.	.	1
2 2 0	.		.	1	.	.	.	.	.	.	.		1
290	.	.		.	.	.	1	.	.	.	.	.	i
330	.		.	1	.	.	.	.	.	.	.		1
550	.	.	.		.	1	.			.	.	.	1
8/16/85 To 8/31/85													
70	.	.	3	.			.		.	.	.	.	3
80	.	.	12	14	.	.	.	.	.	.	.	.	2a
90	.	.	19	23	5		.		.	.	.	.	47
lea	.	2	21	66	12	.	1	.	.	.	.	.	102
110	.	2	7	53	16	.	1		.	.	.	.	79
120	.	.	3	30	14	.		.		.	.		47
130	.	.	.	9	3				.	.	.	.	12
140	.			1	2	.	.						3

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 4. Sheefish (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
SHEEFISH CONT. 9/01/85 TO 9/18/85													
70	.	.	.		1	.	.	.		.	.		1
80	.	.	1	1	2	.	.	.		.	.		4
?3	.	.	2	5	1	.	.	.	.	.	.	.	8
100	.	.	4	12	4	.	.	.	.	.	.	.	20
110	.	.	5	31	23	.	.		.			.	59
120		.	4	30	24	.	1	.	.	.	.	.	59
130	.	.	6	29	27	.	1	.	.	.		.	63
140	.	.	2	15	17	.		.	.	.	.	.	34
150	.	.	2	8	10	.	1	.	.	.		.	21
160	.	.	.	3	.	.		.	.	.			3
210	.	.	.		.		1	.	.	.	.		1
400	.	.	.	.	2	.	.	.	.	.	.		2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 4. Sheefish (Continued)

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/10/S5 SHEEFISH													
10	.	.	.		1	.	.	.		1	.	.	2
30	.	.			1		5	.		3			9
40	.			1	6	.	47		20	90	.	.	164
50	.	17	.	4	23	13	86	.	31	254	.		42a
60	1	50	1	23	43	31	4a	.	.	45			234
70		22	11	72	33	42	8	.		7	.	.	195
80		5	25	24	15	32	1	.	.	1		.	163
90	.		32	77	12	20	3	.	.	.	.	.	144
100	.	4	29	2a	20	15	4	.	.	.		.	160
110	.	4	14	07	39	5	1		.	.	.	.	150
120	.		7	60	3a	.	1			.	.		106
130	.	.	6	32	30	1	1	.	.	.			76
140	.		2	18	19	.	.		.	.		.	39
15a			2	12	10	.	1	.	.	.			25
160		.		3			.	.	.	.			3
170	.	.	.	1	.	.	.	.		,	.	.	1
180		.	.	2	.	.	.	.	.	.	.	.	2
190	.		.	2	1	.	1				.	.	4
200	.		.	2	.	.	.	.			.	.	2
21'3	.	.		1			1		.	.		.	2
220	.	.	.	1	.	.	.			.	.	.	1
250				1	2					.	.		3
260	.	.		3			.	.	.	.			3
290		.	.	2	.	.	1	.	.	.	.	.	3
300		.	.	2		.	.	.	.				2
310	.		.		.	.	1	.			.	.	1
320			.	2	.	.	2	.	.	.	.	.	4
330	.		.	1	1	.	1			.	.	.	3
35s	.		.		.	.	1	.			2	.	3
36a	.	.		1	3		.	.	.	.	.	.	4
370	.	.	.	1	1	.	.		.	.	2	.	4
320	.	.	.	.	1	.	.	.	.	.	1		2
390	.	.		.	2	.	1	.	.	.		.	3
400		.	.	.	7	.	.	.	.	.	.	.	7
410		.	.	1	1	.	.	.	.	.	.		2
420	.		,	1	2	.	.	.	.	.	.	.	3
430	.	.	.	.	1	.	.	.	.	.	.	.	1
440	.		.	.	1	.					.	.	1
45s	.	,	.		1	.	.	.	.		.	.	1
460	.	.		.	2		.	.	.	.	.	.	2
470	.		.		3	.	.	.	.		2	.	5
480	.	.	.	1	.	.	.	.	.	1	2		4
500	.			.	1			.	.		.	.	1
510		.	.	.	.	.	.	.	.	.	2	.	2
550		.	.	.	.	1	.	.	.	.		.	1
610	.	.	.	.	.	.	.	.			2	.	2
620		.	.	.	2	.	.	.	.	.	.	.	2
631	.		.	.	.			1	.		.	.	1
660	.	.	.	.	1	.	.	.			.	.	1
722	.	.			1	.	.	.	.	.			1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 5. Length Frequency of Catch by Habitat and Time Period for Humpback Whitefish

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
HUMPBACK WHITEFISH													
6/14/85 TO 6/30/85													
10	.	.	1	.	.	.	.	.	.	.	.	.	1
30	.		.		1	.	.		.	.	.	.	1
60	.	.	.	.	1	.	.	.	.	.	.	.	1
70	.	.	.	1	14	.	2	.	.	.	.		17
80	.	.	2		6a	.	7	.	.	.			77
90		.	3	2	99	.	10	.	.	.	.		114
100	.	.	.	·3	59	.	4	1	.	.			67
110		.	2	2	29	.	1	.	.	.	.		34
120	.				9	.	.	.	.	.		.	9
130	.	.	.	2	6	.		.	.	.		.	8
140	.		.	3	5	.	.	.	.	.		.	a
150	.	.		2	7	.	2	.	.	.	.		11
160	.	.	.	1	10		.		.	`	.	.	11
170	.		1	2	3	.	.		.	`	.	.	6
180	.	.	1	.	4	.	1	.			.		6
190	.	.	1	.	2		.		.	'			3
200		.	.	.	7	.	r	1	.	`	.		8
210	.	.	.	1	6		.	.	.	1	.	.	8
22'3		.	.	.	5		1	2	.	1	.		9
239		.	.	.	10		.	1	.	.	.	.	11
240	.	.		.	10	.	.	3	.	.		.	13
250		.	.	1	4	.	3	.	.	1	2		11
260	.				6	.	.	1	.	1		.	8
270	.		.	.	i	.	2	1	.	1		.	5
200	.	.	.	.	3	.	.	1	.	.	.	.	4
299	.	.	.		4	.	1	2	.	.	.	.	7
300	.	.	.	.	3		1	.	.	.	.	.	4
310	.	.	.		1	.	.		.	1	2	.	4
320	.	.	.	.	2		1	2	.	.	.	.	5
33a	.	.	.	.	4		1	.	.	1	2	.	8
349	.	.	.		1	.	1	1	.	1	.		4
350	.	.	.	.	1	.	.	1	.	.	.		2
360	.	.		.	i	.	.	1	.	.	.	.	2
378	.	.	.	.	2	.	.	2	.	.	.		4
380	.	.	.	.	2	.	.	3	.	.	.	.	s
390	.	.		.		.	.	1	.	1	2	.	4
400	.				.	.	.	1	.	.	.	.	1
410	.			.	.	.		.	.	1	.	.	1
420	.	.	.	.	.		.	1	.	.	.	.	1
432	.	.	.		.	.	.	4		1		.	5
440	.	.	.	.	.		.	3	.	.	.	.	3
450	.	.	.	.	.	.	.	2	.	.	.	.	2
460	.	.	.	#	.	.		1		.	2		3

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 5. Humpback Whitefish (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
HUMPBACK WHITEFISH CONT.													
7/01/85 TO 7/15/2S													
160	.	.	.	.	1	.	.		.	.	.		1
170	,	.	.	.	1		.	.	.	.	.	.	1
190	.	.	.	.	1	.	.		.	.	.	.	1
210	.	.	.		1		.	.		.	.	.	1
230	.		.		.		.		.	.	1	.	1
250	.	.	.	.	1		.	.	.	.	.	.	1
260	.	.	.	.	.	.			.	.	1	.	1
280	.		.		1	.	.	.	.	.	.	.	1
320	.		.	.	2	.	.		.	.	3		5
330	.	.	.		.	.	.	.	.	.	1	.	1
342	.	.	.	.	.	s	.		.	.	1		1
360	.		.	.				.	.	.	1	.	1
390	.		.	.	1	.	.		.	.	.		1
410	,	.	.	.				.	.	.	1	.	1
430	.	.	.		.	.	.		.	.	1	.	1
7/16/85 TO 7/3112S													
130	,	.	.		1		.	.	.	.	.	.	1
160	.	.	.		1	.	1	.	.	.			2
170	.	.	.		.		1	.	.	.	.	.	1
190	.	.	.	.	1	.		.	.	.		.	1
202	.	.	.	.	.		2	.	.	.	.	.	2
210	.	.	.	.		.	1	.	.	.	.	.	1
240	.	.	.	1	.		.	.		.		.	1
250	.	.	.	1	.	.		.	.	.		.	1
262	,	.	.		1		.	.	.	.	.		1
270	.	.	.	4		.		.	.	.	.	.	4
280	.	.	.				1	.	.	.	.	.	1
320	.	.	.	.	.	.	1	.	.	.	.		1
342	.	.		1	.	.		.		.	.	.	1
8/01/6S TO 8/15/05													
120	.		.	.	1	.	.	.	.	.		.	1
13a	.				1	.	.		.	.	.		1
140	.		.		2	1		.	.			.	3
150	.		.	1	1	.	.	.		.	,	.	2
160	.	.		.	2			.	.	.		.	2
170	.		.	1	3	,	.	.	.	.	.		4
180	.	.		.	6		2	.	.	.		.	8
190	.		.	.	5	.	.	.	.	.		.	5
200	.	.	.	1	4		.	.		.	.	.	5
219	.	.	.	1	2	.	.	.	.	.		.	3
220	.			1	2			.	.	.		.	3
23a	.		.		.	.	1	.	.	.		.	1
240	.	.		.	1		1	.	.	.		.	2
250	.	.	.	1	.		1	.	.	.		.	2
260	.	.		1	2	.		.	.	.	.	.	3
278	-.	.	.	5	5	.		.	.	.			10
22a	.	.	.	1	1	.	.	.	.	.	.	.	2
293	.	.	.	2	2	.	2	.	.	.		.	6
310	.	.	.	.		.	1	.	.	.	.	.	1
339	.	.		1	3		2	.	.	.		.	6
390	.	.		.			1	.	.	.		.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 5. Humpback Whitefish (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	s	6	7	8	9	10	11	12	TOTAL
HUMPBACK WHITEFISH CONT.													
8/16/85 TO 8/31/25													
120	.		.	9	7	.		.	.	.	.	.	16
130	.	.	.	24	21	.	.			.	.	.	45
140	.	.	.	22	13		.		.	.	.	.	35
150	.	.	.	5	5	\	.	.	.	.	.	.	10
160	.	.	.	2	2	\	.	.	.	.	.	.	4
170	.	.	.	1	3	\	.	.		.	.		4
122	.	.	.	3	8	\	.	.	.	.	.		11
192	.	.	.	8	15	\	.	.	.		.	.	23
200	.		.	i'	13	\	.			.	.	.	20
219	.	.	.	1	6	\	.	.	.		.	.	7
2 2 2	.	.	.	.	3	\	.	.	2	.	.	.	s
230	.	.	.	2	2	\	.	.	1	.		.	5
2 5 0	.	.	.	.	4	\	.	.	.	.	.	.	4
2 6 9	.	.	.	1	.			.	.			.	1
270	.		.	.	1	\	.				.	.	1
280	.	.		.	2	\		.		.	.	.	2
290	.	.	.	.	.	\	.	.	1		.	.	1
3 2 4	.	.		.	1	\		.	.	.	.	.	1
310	.	.	.	.	.	\		.	i?	.		.	2
3 3 0	.			.			.	.	1			.	1
9/01/85 TO 9/18/85													
100	.	.	.	.	i	\		.	.	.		.	1
110	.	.	1	.	.	\	.			.	.	.	1
13a	.	.	.	.	3	1	.	.	.	.	.	.	4
140	.		.	1	3	.	.	.	.	.	.	.	4
150	.	.	.	.	6	1		.	.	.	.	.	7
160	.	.	.	1	.	.	.	.	.	.	.	.	1
190	.	.	.	2	3	.		.	.	.	.	.	5
200	.	.	.	.	5	.	.	.	.	.	.	.	5
210	.	.		.	2		.	.	.	.	.	.	2
23a	.	.	1		1	.	.	.	.	.	.	.	2
242	.	.	.	.	i			.	.	.	.	.	1
260	.	.	1	.	1	.	.		.	.	.	.	2
278	.	.	.	.	1			.	.	.	.	.	1
3 2 9	.	.	.	.	1	.	.		.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 5. Humpback Whitefish (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85 HUMPBACK WHITEFISH													
10	.	.	1	.	.		.					.	1
30				.	1	.	.	.	.	.			1
60			.	.	1	.	.		.			.	1
70				1	14	.	2	.	.	.	.		17
80		.	2	.	68		7		.	.			n
90	.		3	2	99	.	10	.	.	.	.		114
100				3	w	.	4	1	.	.	.		68
110			3	2	29	.	1	.		.	.	.	35
120	.			9	17		.	.	.	.	.		26
130	.		.	26	32	1	.	.		.	.	.	59
140	.	.	.	26	23	1	.	.	.	.	.	.	50
150	.	.	.	a	19	1	2		.				30
160	.	.	.	4	16		1			.		.	21
170		.	1	4	10		1		.	.			16
180			1	3	18		3					.	25
190		.	1	10	27	.	.	.	.	.	.		3a
200		.	,	a	29	.	2	1	.	.		.	4a
210				3	17		1		.	1	.		22
220		.	.	1	10		1	2	2	1			17
230	.		i	2	13	.	1	1	1	.	I		20
240		.		1	12	.	1	3		.	.		17
250	.		.	3	9	.	4	.		1	2	.	19
260	.		1	2	10	.	.	1	.	1	1		16
270	.	.	.	9	8		2	1		1		.	21
280	.		.	1	7	.	1	1	.	.	.		10
290		.	.	2	6		3	2	1		.	.	14
300	.		.		4	.	1	.		.	.	.	5
310		.	.	.	1		1		2	1	2		7
320	.	.	.	.	5		2	2			3	.	12
33a	s	.	.	1	7	.	3		1	1	3	.	16
340		.	.	1	1		1	1	.	1	i	.	6
359	.	.	.	.	1	.	.	1	.	.		.	2
360	.	.	.	.	1	.	.	1	.	.	1	.	3
370	.	.	.	.	2	.	.	2	.	.		.	4
380	.	.	.	.	2		.	3	.		.	.	5
390	.	.	.	.	1	.	1	1	s	1	2		6
400	.	.	.	.	.		.	i	.	.	.	.	1
410		.	.	.	.	.	.	.	.	1	1		2
420	.	.	.	.			.	1	.		.	.	1
430		.	.	.	.	.	.	4	.	1	1		6
440			.	.	.	.	.	3	.	.		.	3
450	.	.		.	.	.	.	2	.	.	.		2
460		.	.	.	.	.	.	1	.	.	2	.	3

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 6. Length Frequency of Catch by Habitat and Time Period for Broad Whitefish

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
BROAD WHITEFISH													
6/14/6S TO 6/30/85													
60	.	.	.	.	3	.	.	.	.	.	.		3
90	.	.	.		1		.	.	.	.			1
100	,	.		1	3	.	1		.	.	.	.	5
110	.	.	.		1	.	.	.	.		.	.	1
120	,	.	.	1	2	.	.	.	.	.		.	3
153	,	.	.	.	1	.	1		.	.		.	2
160	.	.	.	.	1			.	.	.	.	.	1
200	.	.	.	.	2	.	.	.	.	.		.	2
210	,		.	.	1		.	.		1	.	.	2
220	.	.	.	.	2	.		.	.	.	.	.	2
23$	.	.		.	1	.	.	.	.		.	.	1
270	.		.	.	1		.	!		.	.	.	2
280	.	.	.	.		.	.	1	.	.	.	.	1
2 %	.	.	.	.	1	.	.	1	.	.	2	.	4
300	.	.	.	.	1	.	.	.	.	.		.	1
320	.	.			.	.	.	1	.	.	.	.	1
34a	.	.	.	.		.	.	1	.	.	.	.	1
360	.	.	.	.		.	1		.	.		.	1
400	.		.	.	.		.	1		.	.	.	1
7/01/85 TO 7/15/85													
2 . 0	.	.	.	1	.		.	.	.	.	1	.	2
90	.	.	.	2	.		.	.		.	1		3
100	.	.	.	1	.	.	.		.	.	2	.	3
110	.	.	.	4	2	.	1	.	.	.	2	.	9
120	.	.	.	2		.	.		.		1	.	3
130	.	.		1	.		.	.	.			.	1
140	.	.	.	1		.	.	.	.	.	.	.	1
170	.	.	.	1	.	.	.		.	.		.	1
210	.	.	.	.		.	.	.	.	.	i	.	1
240	.	.	.	1	.	.	.	.	.	.	.	.	1
260	.		.	.	.	.		.		.	1	.	1
310	.	.	.	.		.	.	.	.	.	1	.	1
326	.	.	.	1	.		.	.			.	.	1
7/16/85 TO 7131105													
170	.	.			.	.	i		.	.			I
19a	.	.	.	1	.		.	.	.	.		.	1
248	.	.	.	1	.	.		.	.	.	.		1
8/01/85 TO 8/15/85													
100	.	.	.	.	.	1	.	.	.			.	1
120	.	.	.	.	1	.	.	.	.	.		.	1
130	.		.	.	2	.	.				.	.	2
140	.	.	.	.	1		.	.	.	.		.	1
210	.	.	.	.	1	.	.	.		.	.	.	1
262	.	.	.	1	.	.	.	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 6. Broad Whitefish (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	19	11	12	TOTAL
BROAD WHITEFISH CONT. 8/16/85 TO 8/31/85													
110	.	•	•	1	•	•	•	•	•	•	•	•	1
132	.	•		2	•	•	•	•	•	!	•	•	3
9/01/25 TO 9/18/85													
100	.	•	•	•	5	.	•	•	•		•	•	5
110	.	•		1	2	.	•	•	•	•	•	•	3
122	.	•		.	4	•	•	•	•	•	•	•	4
130	.	•	•	.	9	.	•	•			•	•	9
140	.	•		.	7	.		•	•	•	•	•	7
150	.	•	•	.	3	.	•	•				•	3
170	.	•		.	1	.	•	•	•	•	•	•	1

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	a	9	10	11	12	TOTAL
6/14/85 TO 9/18/85 BROAD WHITEFISH													
80	•	.	.	1	3	•	•				1	•	5
90	•	•	•	2	1	•	•	•	•	•	1		4
100	,	,	,	2	a	1	1				2	•	14
110,	.		.	6	5	.	1		•	•	2	•	14
120	.	.	,	3	7			•		•	1	•	11
130	,	.	,	3	11	.	.		•	1		•	15
140	.	,	.	1	8				•	.	.	•	9
1 S 3		.	, .	.	4	.	I			.	.	•	s
160	•	•	•	•	1			•	•	.	.	•	1
170	.	,	.	1	1		1			.		•	3
190	.	,	,	i	.	.			•	.		•	1
200	•	.	.	.	2			•		.		•	2
210	.	.	.	,	2			•	•	1	1	•	4
220	•	•	,	•	2	.				.	.	•	2
230	,	,	,	•	i	,			•	.	.		1
24a	.	,	.	2				o			.	•	2
260	•	•	•	•	.		.	.	•		1	•	i
270	•	•	•	•	1			1	•	.	.	•	2
2 2 4	,	.	,	1		.		I	•	.			2
290	•	•	•	•	1			1	•	.	2	•	4
300	•	•	•	•	1		.		•	.			1
310	,	,	,	,		.	.	.	•	.	1	•	1
320	•	•	•	1	.		.	1	•				2
3 4 2	•	•	•	•		.		1		.	.		1
3 6 a	• .	•	•	•		.	1					•	1
4 9 a	,	•	•	•		.	.	1	•				1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 7. Length Frequency of Catch by Habitat and T· me Period for Unidentified Whitefish

						HABITAT							
FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
UNIDENTIFIED WHITEFISH													
6/14/85 TO 6/30/85													
20	.		.	.	.	.	4		.	.	.	.	4
3 9	.	.	.	.	.	.	5		.	.		.	s
7/01/85 TO 7/15/85													
20	.			.	.	.	5	.			.	.	s
3 9	.	.	.	.	.	2	3s			.	.	.	37
40	.			.	.	.	18		.		.	.	18
7/16/85 TO 7/31/2S													
3 e	.	.			1	.	.		.	2	.	.	3
4 0	.	.	.	1	31	.	15	.		54		.	101
5 $	.	.	.	21	91	11	19		.	88			230
60	.		.	27	37	12	7	.		10			93
70	.		.	14	7	15	2		.	1			-39
80	.	.	.	11	1	15		.			.		27
90	.	.	.	5	.	2	.	.				.	7
100	.			2		.	1		.		.	.	3
110	.	.	.	13	3	1	2	.				.	19
120	.		.	13	3	1	1	.	.	.		.	18
130	,	.	.	6	.	.		.		.	.	.	5
140	.			4	1	.	.	.	.	.	.	.	s
160	.		.	3	.	.		.		.	.	.	3
170	.		.	5	.	.	.	.	.	.	.	.	5
180	.			4	.	.	.	.		.	.	.	4
190	.	.	.	3	.	.	.		.	.	.	.	3
2 0 0	.			1	.	.	.	.	.	.	.	.	1
210	.	.	.	1		.	.		.	.	.		1
230	.		.	2	.	.	.	.		.	.	.	2
8/01/85 TO 8/15/85													
30	.			.	.	.	1	.	.	.	.	.	1
40	.	.	.	4	9	.	20	.	.	13	.	.	46
50	.	.	3	55	132	2	52		.	110	.	.	360
60	.	.	8	62	123	38	42	.	.	3s	.	.	317
7 0	.	1	.	25	35	53	23		.	4	.		141
80	.		.	8	13	23	10	.	.	1			55
90	.	.	1		4	8	3		.	.	.		16
100	.	.	.	1	.	,	.	.	.	.	.	.	1
110	.	.	.	1	4	.	1		.	.	.		6
120	.	.	.	.	7	.		.		.	.	.	7
130	.	.	.	4	2	.	1	.	.	.	.	.	7
140	.	.	.	1	1	.		.	.	.	.	.	2
160	.	.	.	1	.		.	.		.		.	1
180	.		.	2	.	.	.	.	.	.	.	.	2
190	.	.	.	1	.	.	.	.		.	.	.	1
220	.			1	.	.	.	.	.		.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTÈRVAL (E.G. 30=30 TO 39 MM)

Tab' e 7. Unidentified Whitefish (Continued)

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
UNIDENTIFIED WHITEFISH CONT.													
8/16/85 TO 8/31/85													
40.		.	.	.	3	.		.		.	.		3
58.		.	.	12	35	.	.		.	13	.		60
6’3	.	,	2	44	54	.	1	.	.	3$	.	1	132
70	.	1	.	%	46	.	2		1	32			17s
80,		.		31	28	.	.	.		19	.		7a
90.		.	.	2	4	.	.		.	5	.	.	11
100	#	.		2	1	.	.	.	.	.	.		3
110	.	,	.	6	4	.	.		.	.	.		10
128.		.		2	3	.		.	.	1	.		6
130	.	.	.		.	.	.		.	1	.	.	1
140	.	.	.	1	.	.		.	.	.	.		1
170	.	.	.	.	.	.	.		.	1	.	.	1
9/01/S5 TO 9/18/85													
68.		.	.	.	4	.	.	.	.	.	.	.	4
70	.	.	3	2	43	.	.	.		2		.	50
se.		.	7	3	50	2	.		.	.	.		62
90.		.	2	.	7	9	.	.			.	.	18
100	.	.	1	.	4	1	.		.	.	.	.	6
110	.	.	.	.	1	1	.	.		.	.	.	2
12s	,	.	.	.	2	.	.		.	.	.	.	2
138.		,		.	2	.	.	.	.		.	.	2
150	.	,	.	.	1	.	.	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

/A LENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85													
UNIDENTIFIED WHITEFISH													
20	.	.	.		.		9	.	.		.	.	9
3 a	.			.	1	2	41		.	2	.	.	46
4 0	.	.	.	5	43		53		.	67	.	.	160
5 s	.	.	3	88	258	13	77			211		.	650
6 0	.	.	10	13s	210	50	50		.	70	.	1	546
70	.	2	3	137	131	60	27	.	1	39		.	400
6 8	.	.	7	53	92	4s	10		.	28	.		222
90	.	.	3	7	15	19	3	.		5		.	52
100	.	.	1	5	5	1	1			.	.	.	13
110	,	.	.	28	12	2	3			.		.	37
120	.	.	.	15	15	1	1	.	.	1	.	.	33
130	.	.		10	4	.	1	.		1		.	16
140	.	.		6	2		.	.	.	.	.	.	8
150	.	.		.	1	.	.			.			1
16s	.	.	.	4	.		.	.	.	.	.	.	4
170	.	.	.	5	.	.	.			1		.	6
180	.			6	.		.	.		.	.	.	6
190	.	.	.	4	.	.	.		.	.		.	4
200	.	.	.	1	.	.	.	.	.	.	.	.	1
210	.	.	.	1		.	.		.		.	.	1
2 2 2	.	.		1			.	.	.		.	.	1
23s	.	.	.	2	.	.	.			.		.	2

' FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 8. Length Frequency of Catch by Habitat and Time Period for Bering Cisco

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
BERING CISCO													
6/14/85 TO 6/30/85													
80	.	.	.	.	.	.	1	.	.	.	.	.	1
14s	.	.	.	.	.	.	1	.	.	.	.	.	1
170	.	.	.	.	1	.	.	.	.	.	.	.	1
290	.	.	.	.	1	.	.	.	.	.	.	.	1
7/01/S5 TO 7/15/85													
260	.	.	.	1	.	.	.	.	.	.	.	.	1
270	.	.	.	1	.	.	.	.	.	.	.	.	1
300	.	.	.	1	.	.	.	.	.	.	.	.	1
319	.	.	.	1	.	.	.	.	.	.	.	.	1
330	.	.	.	1	.	.	.	.	.	.	.	.	1
340	.	.	.	1	.	.	.	.	.	.	.	.	1
360	.	.	.	2	.	.	.	.	.	.	.	.	2
440	.	.	.	1	.	.	.	.	.	.	.	.	1
7/16/6S TO 7/31/85													
150	.	.	.	1	.	.	.	.	.	.	.	.	1
240	.	.	.	1	1	.	.	.	.	.	.	.	2
26s	.	.	.	1	.	.	.	.	.	.	.	.	1
290	.	.	.	6	.	.	.	.	.	.	.	.	6
300	.	.	.	2	.	.	.	.	.	.	.	.	2
310	.	.	.	1	.	.	.	.	.	.	.	.	1
320	.	.	.	1	.	.	.	.	.	.	.	.	1
330	.	.	.	9	.	.	.	.	.	.	.	.	9
340	.	.	.	2	.	.	.	.	.	.	.	.	2
350	.	.	.	1	.	.	.	.	.	.	.	.	1
360	.	.	.	3	.	.	.	.	.	.	.	.	3
379	.	.	.	1	.	.	.	.	.	.	.	.	1
8/01/85 To 8/15/85													
70	.	.	1	.	.	.	.	.	.	.	.	.	1
110	.	.	.	4	.	.	.	.	.	.	.	.	4
120	.	.	.	1	.	.	.	.	.	.	.	.	1
130	.	.	1	4	.	.	.	.	.	.	.	.	5
140	.	.	.	2	.	.	.	.	.	.	.	.	2
150	.	.	1	.	.	.	.	.	.	.	.	.	1
160	.	.	.	.	1	.	.	.	.	.	.	.	1
170	.	.	.	.	1	.	.	.	.	.	.	.	1
270	.	.	.	1	1	.	.	.	.	.	.	.	2
2s9	.	.	.	1	.	.	.	.	.	.	.	.	1
290	.	.	.	6	.	.	.	.	.	.	.	.	6
300	.	.	.	4	.	.	.	.	.	.	.	.	4
320	.	.	.	1	.	.	.	.	.	.	.	.	1
33s	.	.	.	1	1	.	.	.	.	.	.	.	2
340	.	.	.	4	.	.	.	.	.	.	.	.	4
350	.	.	.	.	1	.	.	.	.	.	.	.	1
360	.	.	.	1	.	.	.	.	.	.	.	.	1
370	.	.	.	1	.	.	.	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 8. Bering Cisco (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
BERING CISCO CONT.													
8/16/85 TO 8/31/25													
100	.		.	.	1	.	.	.	.	.	.		1
150	,	.	.	1	.	.	.	.	.	.		.	1
160	.	.		1	.	.	.	.	.	.	.		1
170	,	.	.	1	.	.	.	.		.		.	1
180	.			1		.	.	.	.	.	.	.	1
190	,	.	.	2	.	.	.	.	.	.		.	2
210	.	.			1	.	.	.				.	1
240	,	.	.	.	1	.	.	.	.	.	.	.	1
260	.	.		2	1	.	.	.				.	3
278	.		.	.	1	.	.	.	.	.	.	.	1
320	.	.		2		.	.	.		.	.	.	2
350	.	.	.	.	1	.	.		.	.	.	.	1
9/01/85 TO 9/18/25													
90	.			2	.	.	.	.		.	.	.	2
100	.	.		1	.	.	.		.		.	.	1
140	,			4		.	.	.	.	.	.	.	4
150	,	.	.	12	.	.		.	.	.	.	.	12
160	,	.		16	.	.	.	.	.		.	.	16
170	.	.	.	8	.	.	.		.		.		8
210	,		.	1		.	.	.		.	.	.	1
220	.	.	.	1	.	.	.	.	.		.		1
230	,	.	.	1		.	.		.	.	.	.	1
240	,	.	.	1	.	.	.		.		.		i
260	.	.	.	2		.		.	.	.	.	.	2
270	.	.	.	4		.	.	.	.		.		4
300	.	.	1	3	2	.		.	.	.	.	.	6
310	,		.	4	2	.	.	.	.	.	.		6
322	,	.	.	2	.	.	.	.	.		.	.	2
349	.	.	.	1	.	.	.	.	.	.	.		1
352	,	.	.	2	.	.	.		.		.		2
360	.	.	.	2		.	.	.	.	.	.		2
400	,	.	.	1	.	.			.		.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 8. Bering Cisco (Continued)

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTK
6/14/85 TO 9/1 8/85 BERING CISCO													
70	.	.	I	.	.	.	.	.		.		.	1
88	.	.	.			.	1	.		.		.	1
98	.			2		.	.			.	.		2
100	.		.	1	1	.	.	.		.		.	2
110	.	.		4		.	.	.	.				4
120	.			1	.	.	.	.		.	.	.	1
130	.	.	1	4		.	.	.		.	.	.	5
148	.	.	.	6	.	.	1	.		.	.		7
158	.	.	1	14		.	.	.	.	.			15
160	.	.		17	1	.	.	.			.		18
170	.	.	.	9	2	.	.		.	.	.		11
180	.	.	.	1		.	.	.	.	.	.		1
190	.	.	.	2	.	.	.		.		.	.	2
210	.	.		1	1	.	.	.	.	.	.		2
228	.		.	1		.	.		.			.	i
238	.	.	.	1		.	.	.	.	.		.	1
248	.	.	.	2	2	.	.	.	.			.	4
268	.	.	.	5	1	.	.	.	.	.	.	.	6
270		.	.	6	2	.		.	.	.	.	.	8
288	.	.		2		.	.	.	.	.	.	.	2
298		.	.	12	1	.		.	.	.	.	.	13
388	.	.	1	10	'2	.	.		.	.	.	.	13
310		.	.	6	2	.		.	.	.		.	8
320	.	.	.	6	.		.		.		.		6
330	.	.	.	11	1	.	.	.		.		.	12
348	.	.	.	8		.	.		.	.	.	.	8
358	.		.	3	2	.	.	.		.			5
368	.	.	.	8	.	.	.		.	.		.	8
370	.		.	2	.	.	.	.		.	.	.	2
480	.		.	1	.	.	.	.	.	.		.	1
448	.	.		1	.	.	.	.	.	.	.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX C

Table 9. Length Frequency of Catch by Habitat and Time Period for Least Cisco

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
LEAST CISCO													
6/14/25 TO 6/30/S5													
3 a	.	.	.	.	.	.	1	.	.	.	.	.	1
4 0	.	.		.	2	.	.	.	.	.	.	.	2
50	.	.	.	.	4	.	.	.	.	.		.	4
6 %	.	.		.	1	.	.	.		.	.	.	1
78	.	.	.	.	8	.	.	.	.	.		.	8
s e	.	.	1	3	27	.	3	.	.	.	.	.	34
90	.		2	7	4s	.	11	.	.	1	.	.	69
100	.	.		4	25	.	2	2		4	.	.	37
110	.	.	1	7	13	.	.	4	.	1		.	26
12s	#	.	1	2	5	.	2	2	.	1	.	.	13
130	.	.		2	6	.	1	1	.	.	.	.	10
14a	,	.	.	1	11	.	1	6	.	.	.	.	19
150	,	.		8	11		.	2		1	.		22
160	.	.	.	2	5	.	2	1	.	3	.	.	13
170	,	.	i	5	7		2	1		1	.		17
1s0	.	.	.	1	9	.	.	.	.	.	.	.	10
190	.	.		3	6	.	3	2		.	.		14
2 0 s	.	.	1		6	.	1	1	.	1	.	.	10
210	.	.		.	4		1	1	.	.	.	.	6
220	.	.	.	1	3	.	1	1	.	.	.	.	6
230	.	.	.		2		2	4	.	1	.	.	9
240	.	.	.	.	9	.	1	4	.	1	.	.	15
2 s 0	.	.	.		1	.	.	1	.	.	.	.	2
278	.	.	.	.	1	.	.	1	.	.	2	.	4
2 9 s	.	.	.	1	.	.	.	.	.		.	.	1
3 0 0	.		.	.	.	.	.	1	.	.	.	.	1
310	.	.	.	.	.	.	.	1	.		.	.	1
7/01/85 TO 7/15/85													
3 9	.	.	.	.	.	.	3	.	.	.		.	3
M	.	.	.	.	.	.	2	.	.	.		.	2
2 0	.	.	.	1	.	.	.	.	.	.	.	.	1
90	.	.		2	1	.				.	.	.	3
100	.	.	.	3	1	.	.	.	.	.	3	.	7
110	.	.	.	5	2		2	.		.	4	.	13
129	.	.	.	1	1	.	.	.	.	.	2	.	4
13s	.	.	.		1		.		.	.	.	.	1
140	,	.	.	.	.		1	.	.	.	.	.	1
150	.	.	.	.	.	.	.	.	.	.	2	.	2
16s	,	.		3	2		.	.	.	.	1	.	6
170	.	.	.	1	2	.	.		.	.	4		7
180	.	.	.	2			.	.	.	.	2	.	4
190	.	.	.	7	2	.	1	.	.	.	2		12
200	.	.		2		.	.		.	.	3	.	5
210	.	.	.	1	.	.	.	.	.	.	.	.	1
220	.	.	.	2		.	.	.		.	3		s
230	.	.	.	.	.	.	.	.	.	.	1	.	1
2 5 0	.	.	.	1		.	.			.	2		3
27s	.	.	.	3		.	.	.	.	.	.	.	3
290	.		.	1	.	.	.	.	.	.	.	.	1
3 6 a	.	.	.	1	.		.	.		.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (2. s. 30=30 TO 39 MM)

APPENDIX C
Table 9. Least Cisco (Continued)

FORKLENGTH A/	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
LEAST CISCO CONT.													
7/16/05 TO 7/31/85													
90	.	.	.	1	1	.	.	.	.			.	2
100	.	.	.	8	.	.	.	.		.	.	.	b
110	.	.		14	1	.	.	.	.	.	.	.	15
12s	.	.	.	10	8	.	.		.				18
132	,			5	1	.	.	.	.	.	.	.	6
140	,			1	1	1	.	.	.	.	.	.	3
150	.	.	.	2	.		.	.	.	.	.	.	2
16s	,	.	.	4	1	.	.	.	.	.			s
170	.	.	.	2		.	.	.	.		.		2
180	.	.	.	.	.	.	1	.		.	.	.	1
190	.	.	.	2			.		.			.	2
200	.	.	.	2	1	.	.	.	.	.		.	3
210	.			.	1		.	.	.	.		.	1
220	.	.		1	.	.	.			.		.	1
23s	,		.	1	.	.	.	.		.	.	.	l
260	,			1	.	.	.	.	.	.	.	.	1
8/01/S5 TO 8/15/S5													
70	.	.	.	1	i	.			.			.	2
2 0	.	.	.	.	1	.	.	.	.	.		.	1
100	.	.		2	1		.	.	.	.	.	.	3
110	.	.	1	9	3	.	.		.			.	13
12s	.			16	3	.	1		.	.	.	.	20
130	,		1	9	1		.	.	.	.	.	.	11
140	.	.	.	4	.	.	.	.		.	.	.	4
150	.			5	.	.	.	.	.	.	.	.	5
160	.	.	.	3	3	.	.	.	.	.	.	.	6
170	.	.	.	4	2	.	1	.		.	.	.	7
1ss	.	.	.	3	5	.	.		.	.		.	8
190	.	.	.	2	3	.	.	.	.			.	5
200	.	.	.	2	1	.	.	.	.		.	.	3
210	.	.	.	1	.	.	.	.	\		.	.	1
2 5 s	.			1	1		.	.		.		.	2
0/16/S5 TO 8/31/85													
70	.	1	.	.	.	.	.	.	\	.	.		1
100	.	.	.	.	1	.	.	.	\	.	.		1
110	.	.	.	1	.	.	.		\			.	1
120	.	.	.	2	7	.	.	.	\	.		.	9
13s	.	.	.	2	2	.	.		\	1	.	.	s
140	.	.	.	.	3	.	.	.	\		.	.	3
160	.	.	.	,	2	.	.	.	\	.	.		2
170	.	.	.		1	.	.	.	\	.	.	.	i
190	,	.	.	.	.	.	.	.	1	.	.		1
200	.			.	1	.	.	.		\	.		1
230	,	,	.	1	.	.	.	.	.	.		.	1
250	.	.	.	.	.	.	.		1	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX C
Table 9. Least Cisco (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
LEAST CISCO CONT. 9/01/25 TO 9/1S/25													
120		.		1		.	.	.	.	.		.	1
130	.	.	.	1	.	.	2	.	.		.	.	3
140	.	.	2	2	4	.	1	.	.		.	.	9
150	.	.	.	1	4	.	3	.	.		.	.	8
160		.	.		5	.	1	.	.			.	6
176	.	.	.	1	1	1	1		.		.		4
180	.	.	.	1	2	.	.	.	.		.		3
190	.	.		1	2	.					.	.	3
200	.	.	1	1		.	.	.	.				2
229	.	.		1	.			.		.	.	.	i

/A FORKLENGTH	1	2	3	4	s	HABITAT 6	7	8	9	10	11	12	Toni
6/14/85 TO 9/18/85 LEAST CISCO													
30			.		.		4	.		.		.	4
40			.	.	2	.	2			.			4
50		.	.	.	4	.	.	.	.	.			4
60	.	.		.	1	.	.		.	.	.		1
70		1	.	1	9	.	.	.	.	.	.	.	11
80	.		1	4	28	.	3	.		.	.		36
90	.	.	2	10	50	.	11		.	1		.	74
100			.	17	26	.	2	2	.	4	3		56
110			2	36	19		2	4	.	1	4		62
120		.	1	32	24	.	3	2		1	2	.	65
130			1	19	11		3	1		1	.		36
140	.	.	2	8	19	1	3	6	.	.		.	39
150		.	.	16	15		3	2	.	1	2		39
160		.	.	12	18	.	3	1		3	1	.	32
170			1	13	13	1	4	1		1	4	.	38
180		.		7	16	.	1			.	2	.	26
190	.	.		15	13		4	2	i	.	2		37
200	.		2	7	9		1	1		1	3	.	24
210		.	.	2	5	.	1	1	.	.	.	.	9
220				5	3	.	1	1			3		13
230				2	2	.	2	4		1	1		12
242		.	.		9	.	1	4		1			1s
252				2	2	.	.	1	1	.	2		a
260		.	.	1		.	.	.		.		.	1
278	.	.		3	1	.	.	1			2	.	7
290	.		.	2	.	.	.	.	.				2
300	.	.	.	.		.	.	1	.	.		.	1
310	.	.		.	.	.	.	1	.		.	.	1
360	.	.		1	.			.					1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 10. Length Frequency of Catch by Habitat and Time Period for Unidentified Cisco

	HABITAT												
FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
UNIDENTIFIED CISCO													
6/14/85 TO 6/30/85													
110	.		.	.			.	1		.	.	.	1
120	.	.	.	.	.	.	.	.	.	1	.	.	1
7/16/85 TO 7/31105													
30	.	.	.		1		.	.	.	.			1
40	9		.	10	21	6	10	.		20	.	.	76
52	40	.	.	30	127	16	12	.		35	.	.	260
50	13	.		15	31	4	3	.		4		.	79
70	.	.	.	11	3	2	.		.	1	.	.	17
2 2	.			1	.	.	.	.	.	.		.	1
90	.	.	.	1	.	.	.	.			.	.	1
8/01/85 TO 8/15/25													
40	.	.	.	2	5		3		.	1	.		11
5 0	.	2	8	28	48	2	8		.	28	.	.	124
62	12	.	13	54	34	9	6	.	.	17	.		145
70	24	.	6	21	10	18	2		.		.	.	81
80	10	.	.	.	1	5	.	.	.	.	.	.	16
9 0	.	.	.	.	1	.	.	.	.		.		1
110	.		.	.	1		.	.	.	.	.	.	1
120	.	.	.	.	1	.	.	.	.	.	.		1
13a	.			.	1		.	.		.		.	1
140	,		.	.	1		.	.	.	.	.	.	1
150	.	.			1		.	.	.	.	.	.	1
8/16/85 TO 8/31/85													
40	.	.	.	i	3	.	.		.	.	.	.	4
50	.	.		18	21	.	.	.	.	12		.	51
60	.	.	2	52	74	.	5	.	.	44	.		103
70	.	.		39	69	.	17	.	.	2s	.	.	150
80	.	.	1	14	10	.	5	.	.	4	.		34
90	.	.	.	1	.	.	1	.	.	2	.	.	4
9101/0S TO 9/10/85													
5 2	.		.	.	i	.	.	.		.		.	1
6 6	.	.	.	4	14	3	4	.		.	.	.	25
7 2	.	2	2	11	23	3	9	.	.	1	.	.	57
80	.	.	4	21	26	6	10	.	.	.		.	67
90	2	.	2	21	15	1	4	.	.	.	.	.	4s
100	3	.	3	9	4	2	.	.	.	.		.	21
110	1	.	1	4	.	.	.		.	.	.	.	6

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 10. Unidentified Cisco (Continued)

						HABITAT							
FORKLENGTH /A	1	i?	3	4	5	6	7	8	9	19	11	12	TOTAL
6/14/25 TO 9/18/S5 UNIDENTIFIED CISCO													
30	.	.	.	.	1	.	.	.	.	.	.	.	1
40	9	.	.	13	29	6	13	.	.	21	.	.	91
50	40	2	8	76	197	18	2 0	.	.	75	.	.	436
60	2s		15	131	153	16	18	.		65		.	423
70	24	2	8	82	111	23	28	.	.	27	.	.	305
80	10	.	5	36	37	11	15	.	.	4	.	,	118
90	2	.	2	23	16	1	5	.		2			51
100	3	.	3	9	4	2	.	.	.	.	.	.	21
110	1	.	1	4	1	.	.	1	.	.	.	.	8
120	.	.	.	.	1	.	.	.		1	.	.	2
130	,		.	.	1	.	.	,	.		.	.	1
140	.	.	.		1	.	.	.	.		.		1
150	.	.	.	.	1	.	.	.	.				1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 11. Length Frequency of Catch by Habitat and Time Period for Unidentified Cisco and Whitefish

FORKLENGTH /A	HABITAT 1	2	4	5	6	7	9	10	11	TOTAL
UNIDENTIFIED CISCO AND WHITEFISH										
6/14/85 TO 6/30/85										
20	.	.		.	.	1		.	.	1
7)01/05 TO 7/15/85										
2 6	.	.		4	.	12	.	4	.	20
3 a	.			45	5	275	7	118	.	450
40	.	.	.	249	33	185	39	263	2	762
50	.	.	.	130	18	30	3	139		320
60	.		.	.	1	2	,	.	.	3
70	.	.	.	2	2	.		.	.	4
100	,	.		5	.	.	.	.		5
110	.	.		5		.	,	.		$
120	.	.	.	1	.	.	.		.	1
130	.	.	.	i	.	.	.		.	1
7/16/25 TO 7/31/85										
2 2	.	.			.	1	.	.	.	1
30	.	1	.	.	2	59	,	1	.	63
40	1	50	.	.	47	143	.	45	.	266
50	.	123	.	.	112	63	,	5s	.	375
60	.	18	.	.	39	13	.	6	.	76
70	,	6	.	.	8	3	,		.	17
320	.		1	.	.	,		.		i

FORKLENGTH /A	HABITAT 1	2	4	5	6	7	9	10	11	TOTK
6/14/25 TO 9/18/85										
UNIDENTIFIED CISCO AND WHITEFISH										
22		.		4		14	.	4	.	22
30	.	1		45	7	334	7	119	.	513
40	1	50	.	240	20	320	39	380	2	1048
50	.	125		130	130	113	3	194		655
60	.	18	.	.	40	15	.	6		79
70	.	6	.	2	10	3	.	.	.	21
100	.	.		5	.	.	.	.	.	5
110	.	.		5	.	.	.	.	.	5
120	.	.	.	1	.	.	.	.		1
130		.	.	i	.	.	.	.	.	1
320	.		1	.	.	,	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 12. Length Frequency of Catch by Habitat and Time Period for Boreal Smelt

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
BOREAL SMELT													
6/14/85 TO 6/30/85													
40	.	.	.	.	1	.	9	.	.	.	.		10
50	.	.	.	2	5	.	11	.	.	.	.	.	la
60	.	.		1	2	.	2	.	.	.	.		5
90	1		1		.	.	1	.	.		.	.	3
100	.	.	.		1	.	5	.		.	.	.	6
110	,		2		.	.	3	.	.	.	.	.	s
120	1		2		.	.	.	.	.		.		3
130	.		1	.	.	.	.	.	.	.			1
140	.	.	4	.	.	.	6	.	.	.		.	10
150	.	1	6	.	.	1	1	.	.	.	.	.	9
16a	.	1	8	.		4	3		.	.	.		16
170	.	1	5		.	2	3	.		.	.	.	11
180	.	.	7		.	4	2	.			.	.	13
190	.	3	2	.	.	.	1	.	.		.	.	6
200	.	1	3		.	.		.	.		.	.	4
210	.	.	1	.		.	.		.	.	.		1
220	.	.	1	.		1	1	.	.	.			3
2 6 8	.	.			.	.	1	.		.	.	.	1
7/01/2s To 7/15/2s													
110	.		.	1		.		.	.		.	.	1
122	.	.		1	.	.	.	.	.	.			1
130	.			2		.	.	.	.	.			2
170	.	.	.	i	.	.	.		.	.	.		1
7/16125 To 7/31/85													
60	1	3	.	.	.		.		.	.	.	.	4
70	1	7	.	.	.	.		.	.		.	.	8
80	.	15			.	.	.	.			.	.	15
90	7	12	.	.		.	.	.	.	.	.	.	19
100	15	3	.		.	.		.			.	.	18
110	17	.		.		.	.	.	.	.		.	17
120	10		.	.	.	.		.	.		.	.	10
130	7	.		.	.		.		.	.	.	.	7
140	6	.	.	1	.	.	.	.	.	.			7
150	2	.		.	.	.	.		.	.	.	.	2
160	.			1	.	.	.	.	.	.	.	.	1
8/01/85 To 8/15/65													
50	8		4	1		3	2	.			.	.	18
69	25	1	21	.		.	1	.	.	.	.		48
70	42		26	.				.	.	.	.		68
80	16	.	23		.		.	.	.	.	.	.	39
93	10	.	3			.	.	.	.	.	.	.	13
183	12	.	.	.	.	.	.		.	.		.	12
110	17	.	2		.	.	.	.		.	.	.	19
129	8		2	2	.	.			.	.	.		12
132	4	.	1	3	.				.	.		.	0
140	5	.		1		.	.	.	.	.	.		6
150	.			1		.		.	.	.	.		i
160	1	.	.		i	.	.	.	.	.	.	.	2
170	1	.			1		.	.		.	.	.	2
200	.	.	.	1	.	.			.	.		.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 12. Boreal Smelt (Continued)

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
BOREAL SMELT CONT.													
8/16/85 TO 8/31/85													
6a	2			.	.	.	.	.	.	.	.	.	2
70	a	.	1	.	.	.	.	.	.			.	9
80	10			.	.	.	.	.	.		.	.	10
90	3	.			.		.	.	.				3
100	3			.	.	.		.	.		.	.	3
110	6		1	.	.	.	.	.	.	.	.	.	7
120	7		.	1	.	.	.	.	.		.	.	8
130	3			.	.		.	.	.	.	.	.	3
140	3			.	.	.	.	.	.		.	.	3
9/01/85 TO 9/18/65													
40	2			.	.	.	.	.	.	.		.	2
5a	1	.	.			.		.		.	.	.	1
6a	13		.	.	.		.	.	.	.		.	13
70	23	.	.			.		.		.	.		29
20	53				.		.	.	.				53
9a	47	.	.			.	.			.	.	.	47
100	2a	.	.	.	.	.	.	.	.	.		.	20
119	1	.	.		.	.				.	.	.	1
120	2	.	.		.		.	.	.	.	.	.	2
130	i?	.	.	.	.	.	.	.		.	.	.	2
160	1	.	.		.	.	.	.	.	.	.	.	1

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
6/14/65 TO 9/18/85													
BOREAL SMELT													
4a	2	.	.	.	1	.	9	.	.			.	12
5a	9	.	4	3	5	3	13	.		.	.		37
60	41	4	21	1	2	.	3	.	.	.		.	72
70	80	7	27	.	.	,	.	.	.	.			114
80	79	15	23	.	.	,.	.	.	.	.	.	.	117
90	6a	12	4	.	.	.	1	.	.				85
100	58	3	.	.	1	.	5	.	.	.	.		59
110	41	.	5	1	,	.	3	.	.	.	.		58
120	28	.	4	4	.	.	.			.	.	.	36
130	16	.	2	5	.	.	.	.	.	.	.	.	23
14a	14	.	4	2	.	.	6			.	.		26
15a	2	1	6	1	.	1	1	.		.	.	.	12
160	2	i	8	1	1	4	3	.	.		.		2a
170	1	1	5	1	1	2	3			.			14
180	.	.	7	.	.	4	2	.	.			.	13
19a	.	3	2	.	.	.	1		.	.			6
200	.	1	3	1	.	.	.	.	.		.		5
210	.	.	i	.	.	.	.	.	.				1
220	.	.	i	,	.	1	i	.	.	.			3
26a		..,.		.		.	1	.	.		.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 13. Length Frequency of Catch by Habitat and Time Period for Pond Smelt

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
POND SMELT													
6/14/85 TO 6/30/05													
9a	.		.	.	5	.	.	.	.	.	.	.	S
100	,	.		.	5	.	.	.		.		.	S
110	.	.	.	.	6	.	.	.	.	.		.	6
7/01/85 TO 7/15/85													
40	.	.	.	.	.	.	2		.	.		.	2
7/16/85 TO 7/31/85													
se	.	.		.		.	1	.			.	.	1
60	.	.	.			.	1	.	.	.	.	.	1
8/01/85 TO 6/15/85													
40	.	.		.		3	.	.	.	.	.	.	3
50	.		1		.	14	2	.	.		.	.	17
60	12	.	4		.	12	.		.		.	.	20
70	24		7	.	.	3		.	.		.	.	34
80	5	.	3	2	.	.		.	.		.	.	10
9a	4	.	.	.	.	.	.	.	.	.	.	.	4
100	2	.	1		.	.		.	.		.	.	3
110	1		.	.	.	.	.	.	.	.	.	.	1
8/16/25 TO 8/31/85													
40	.		.	.	.	.	2	.	.		.	.	2
50	.	2	1	1	.		3	.	.	.	.	.	7
60	2	1	3	1	.	.		.	.	.	.	.	7
70	2	.	1	2		.	.	.	.	.		.	s
80	2		.	.	.	.	.	.	.	.	.	.	2
9/01/25 TO 9/18/85													
10	.		i	.	.	.		.	.	.	.	.	1
30	12	.	.	2	.	1	5	.	.	.		.	20
40	76		.	2	.	.	57	.	.	.	.	.	135
50	43	.		.	.	.	2	.	.	.	.	.	45
60"	16		.	.	.	.	.	.	.	.	.	.	16
70	42	.	1	.	1		.	.	.	.	.	.	44
80	39	.	.	.		.	.	.	.	.	.	.	39
90	8	.		.	.	.	.	.	.	.	.	.	8
100	7	.		1	.	.	.	.	.	.	.	.	8
110	2		1	1	.	.	.	.		.	.	.	4
120	,	.		3	.		.	.	.	.	.	.	3
130	.	.	.	1	.	.	.	.		.	.	.	I

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 13. Pond Smelt (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85													
POND SMELT													
10	.		1		.	.	.	.		.	.	.	1
3a	12	.		2		1	5	.	.	.	.	.	29
40	76		.	2	.	3	61	.		.			142
50	43	2	2	1		14	8	.		.	.		70
60	30	1	7	1	.	12	1		.				52
70	68	.	9	2	1	3	.	.			.	.	83
80	46		3	2	.	.		.	.	.			51
90	12	.	.	.	5	.	.	.			.	.	17
100	9		1	1	5	.			.	.			16
110	3		1	1	6	.	.	.		.			11
120	.			3	.	.	.		.	.	.	.	3
130	.		.	i	.	.	.	.		.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX C

Table 14. Length Frequency of Catch by Habitat and Time Period for Unidentified Smelt

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
UNIDENTIFIED SMELT													
7/16/85 TO 7/31/85													
3 a	.	1	.			.		.			.	.	1
40	.	15	.	.	.		.	.	.	.		.	1s
5 s	.	12			.		.			.	.	.	12
70	.	1		.		.	.	.	.				1
8/01/85 TO 8/1S/S5													
2 a	.		.	.	.	.	25	.			.		25
30	.	1	2$,		.	1	190	.	.	.	.	.	218
4 s	.		19	,	,	4	B	.		.	.		31
5 0	.	.	13	,	.	i	.	.	.	.	.	.	14
6 0	.		3	.	.		.			.	.		3
8/16/85 TO 8/31/85													
2 s	.		.				2	.	."				2
3 8	.	1				.	18			.	.	.	19
#	.	.					7	.	.		.	.	7

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85													
IM102NTIFIEII2ELT													
20	.	.	.	.	.	.	27	.	.	.	.		27
3 0	.	3	2 5	.	.	1	208		.		.	.	23s
4 8	.	15	19	.	,	4	15	‡	.		.	.	53
50	.	12	13	.	.	1	.	.		.	.		26
60	.	.	3	.	.	.	.	'	'	'	'		3
70	.	1	.	.	.	.	.		.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 15. Length Frequency of Catch by Habitat and Time Period for Ninespine Sticklebacks

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
NINESPINE STICKLEBACK													
6/14/2S706/36/S5													
30	.	.	.	.	.	.	1	.					1
40	.	1	.	.	33		9		.		.	.	43
5 s	.		.	.	141	.	3	2		.			146
60	.		.		10	.	2	1 '	.		.		13
7/01/25 TO 7/15/S5													
40	.	.	.	I		.		.		.	.		1
50	.		.	1	.	.	.	.	.		.		1
60	.	.	.	.	.	.		.	1	.	.		1
7/16/85 TO 7/31/85													
4s	20	1	.	.	2	.				.	.		23
5s	25	4	.	.	26	.	6	.	.	.	.		61
60	.	4	.	.	23	.	2	.	.	.	.		29
7$	.	1			.	.	.	.		1	.		2
8/01/85 m 8/15/85													
20	.	.	.		2	.	10	.	.	.	.	.	12
30	.	2	4	1	3	.	24	.	.	.	.	.	34
4s	i		14	.	.	2	4	.	.	.		.	21
5s	18		4	5	.		1	.		.	.		28
60	22	.	2	4	.	1	.	.	.	.		.	29
70	.		1	.	.	.	.	.	.	.	.		1
0/16/SS TO 8/31/SS													
20	.	.	.	1	23	.	.	.	.	.		.	24
30	.	4	.	2	64	.	1	.	.	7	.	.	78
40	.	5	1	.	20	.	.	.	.	34		.	60
50	1	3	.	2	20	.	.	.	.	21	.	.	47
60	4	2	.	3	25	.	.	.	.	21		.	55
70	.	.	.	.	3	.		.	.	4	.	.	7
9/01/85 TO 9/18/S5													
20	.	10	.		11	.		.	.	.		.	21
30	23	37	2	9	64	.	15	.	.	.	.	.	150
4s	10	67	.	21	4s	1	9	.	.	1		.	157
50	13	21	.	10	27	1	2	.	.	.	.	.	74
6s	a	11	.	.	14	.	1	.	.	.		.	34
70	i	5	.	1	3	.		.	.	.	.	.	10

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 15. Ninespine Sticklebacks (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18125 NINESPINE STICKLEBACK													
20	.	10	.	1	36	.	le	.	.	.	.	.	57
3a	23	43	6	12	131	.	41	.	.	7	,	.	263
40	31	74	15	22	103	3	22	.	.	35	.	,	305
50	57	20	4	18	214	1	12	2	.	21	.	.	357
60	34	17	2	7	72	1	5	1	1	21	.	.	161
70	1	6	1	1	6	.	.	.	.	5	.	.	20

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 16. Length Frequency of Catch by Habitat and Time Period for Arctic Lamprey

FORKLENGTH /A `	1	2	3	4	s	HABITAT 6	7	8	9	10	11	13	TOTAL
ARCTIC LAMPREY													
6/14/85 TO 6/30/85													
50	.	.	.	.	.	.	1	.	.	.	.		1
6 0	.	.	,	.	.	,	1	.		.	.	.	1
1 0 0	.	.	,	.	.	.	1	.	.	.			1
1 2 0	.	,	.	.	2	.	5		.	.			7
130	.	.		.	.	2	1	.		.	.	.	3
140	.	.	1	.	.	i	2	.	.	.	`	.	4
150	.	1	.	.	.	.	1		.	.	`	.	2
160	.	.	1	.	.	,	.		.	.	`		1
100	.	.	.	.	.	1	.	.	.	.		.	1
7/01/85 To 7/15/85													
6 0	.	.	,	.	.	.	1	.	.	.			1
90	.	.	.	.	.	.	3		.	.		.	3
100	.	.	.	.	.	,	2	.		.	.	.	2
12$	.	.	.	.	.	.	1	.	.	.	.	.	1
13%	.	.	.	.	,	1	.		.	.	.		1
7/16/85 TO 7/31/85													
160	1	.	.	.	.	.					.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

FORKLENGTH /A	1	2	3	4	5	HABITAT 6	7	a	9	10	11	13'	TOTAL
6/14/85 TO 9/18/85 ARCTIC LAMPREY													
50	.	.	.				1		.			.	1
60	.	.	.	.	.	.	2	.	.	.		.	2
90	.	.	.			.	3		.	.	.		3
100	.	.					3		.	.			3
120	,	.			2		6		.	.	.		8
130	.	.	.		.	3	1	.			.	.	4
148	,	.	1	.		1	2	.		.			4
150	.	1	,		.	,	1			.	.		2
160	1		1						.	.			2
180	.		.		.	1					.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 17. Length Frequency of Catch by Habitat and Time Period for Longnose Sucker

/A FORKLENGTH	HABITAT 1	i?	3	4	5	6	7	8	9	10	11	13	TOTAL
LONGNOSE SUCKER													
6114/2S TO 6/30/85													
40	.		.		1		.		.	.	.	.	1
60	.		.	.	1	.	.	.		.	.		1
90	.	.	.		.	.	1		.	.	.	.	i
100	.		.		4			1		1	.		6
110	.	.	.	.	5	.	.		.	.	.	.	5
120	,		.		1		i	1	.	,	.		3
7/01/85 TO 7/15/85													
60	.	.	.	.	.	.	.	.	.	1	.	.	1
80	.		.		.	.	1		.	.	1	.	i?
100	.	.	.	.	1	.	.	.	.	.	.		1
110	.	.	.		2	.			.		1	.	3
120	,			.	1		.	.	.	.	1		2
140	.	.	.				1		.	.	.		1
230	,		.	.	.	.	.	.	.	.	1	.	1
7/16/25 TO 7/31/85													
110	.	.			1	.	.	.	.	.		.	1
120	.	.	.	1	1	.			.	.	.	.	2
130	.	.		1	.	.	.	.	.	.		.	1
140	.	.	.	.	.	.	1		.	.	.	.	1
150	,	.		1		.		.	.	.		.	i
8/01/85 TO 8/15/85													
2 a	.	.		.	1	.	.	,	.	.		.	1
3 a	.	.		.	1	.		.	.	.		.	1
50	.	.	.	.	1	.	i	.	.	.	.	.	2
78	,	.		.	1	.	.	.	.	.		.	1
80	.				i	1	.	.			.		2
90	.	.		.	2	.	1	.	.	.			3
100	.	.	.		2		1				.		3
110	,		.		3	.	.	.	.	.	.		3
120	.	.	.		6	.	1		.	.	.	.	7
130	.		.	1	2	.	.	.			.		3
140	.	.	.	1	8	.	1		.	.	.	.	10
150	.	.	.	2	4			.			.		6
160	.	.	.	1	6	.	3		.	.	.		10
170	.	.		1	2		.	.			.	.	3
180	.	.	.	1	1	.	.	.	.	.	.	.	2
190	.	.	.		.	.	1	.	.	.	.	.	1
2 2 0	.	.		1	1	.	.				.	.	2
8/16/85 TO 8/31/85													
70	.	.	.		.	.	.	.	.	1	.	.	1
130	,		.		1	.							1
140	.				.	.	.		1	.	.	.	1
160	,			1				.		i?			3
190	,			1	.				,			.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

Table 17. Longnose Sucker (Continued)

FORKLENGTH la	HABITAT 1	2	3	4	s	6	7	8	9	10	11	13	TOTAL
6/14/85 TO 9/18/85													
LONGNOSE SUCKER													
2s	.	.	.	.	1	.	.	.					1
30	i	.	.	.	1	.	.	.		.	.		1
48	.	.	.	.	1	.	.	.	.		.		1
50	.	.	.	.	1	.	1		.	.	.		2
68	.	.	.	.	1	.	.	.	.	1			2
70	.	.	.	.	1	.	.		.	1	.		2
80	.	.	.	.	1	1	1	.			1		4
w.	.	.		.	. 2	.	2	.	.	.		.	4
lea.	.	.		.	7	.	1	1		1			10
110	.	.	.	.	11	.	.	.	.		1		12
120	.	.	.	1	9	.	2	1	.	.	1		14
130	.	.	,	2	3	.	.	.			.		5
140	,	.	.	1	8	.	3	.	1	.	.		13
15s	.	.	.	3	4	.	.	.				.	7
16s	,	,	.	2	6	.	3	.	.	2			13
170	.	.	,	1	2	.			.	.	.	.	3
188	.	,	,	1	1	.	.	.		.	.		2
190	,	,	,	1	.	.	1	.	.	.	.		2
228	.	.	.	1	i	.	.	.	.	.		.	2
230	.	.	.	.	.	.	.	.	.		1		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 18. Length Frequency for Catch by Habitat and Time Period for Northern Pike

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	13	TOTAL
NORTHERN PIKE													
6/14/25 TO 6/30/85													
280	.	.		.	.	.		.	.	1	.	.	1
310	.	.	.		.	.		.	.	1	.	.	1
3 4 8	.	.	.			.		1	.	.	.	.	1
3 6 8	.		.		.	.	1	.	.			.	1
370	.	.	.	.	.	.	.		.	1	.		1
3 9 8	.	.	.		.	.		.		2	.	.	2
400	.	.		.		.	.	1	.	.	.	.	1
4 4 8	.	.	.		.	.		1			.	.	1
452	.	.	.	.			.	1	.	.	.	.	1
460	.		.		.	.		1		.	.	.	1
510	.	.	.	.			.	1	.	.	.	.	1
5 3 8	.	.	.		1	.		.	.	2	.	.	3
5 6 8	.	.	.	.	1	.	.		.	.	.	.	1
610	.	.	.		.	.		.	.	1	2	.	3
620	.	.	.		.	.	.	1	.	1	.		2
6 3 8	.	.	.		.	.		.	.	1	.	.	1
640	.	.	.				.	1	.	.	.	.	1
670	.	.	.		.		.	1		1	.	.	2
7/01/85 TO 7/15/85													
2 2	.	.	.	.		.	1		.	.	.	.	1
30	.	.			.	.	.	.	1		.	.	1
290	.	.	.	.	.	.	.		2	.	.	.	2
300	.	.	.		.	.		.	1	.	.	.	1
330	.	.	.	.		.	.	.	2	1	.	.	3
3 4 8	.	.	.	.	.	.			3	.	.	.	3
350	.	.		.				.	1	2	.	.	3
37e	.	.	.	.	.	.	.	.	1	1	.	.	2
380	.	.		.		.	.	.	1	.	.	.	1
3 % 3	.	.	.	.	1	.	.		.	.	.	.	1
400	.	.		.	.		.	.	1	.	.		1
410	,	.	.	.	.	.	.		.	1	.	.	1
430	.	.	.	.	.	.	.	.	1	.			1
4 4 0	.	.		.	.	.	.		.	1	.	.	1
460	.	.	.	.	.	.	.	.	1	.			1
490	.	.	.	.		.	.	.	1	.	.	.	1
7/16/25 TO 7/31/05													
100	.	.	.	1	.	.	.	.	.	.	.		1
3 4 8	.	.	.	.			.	.	.	1	.		1
350	.	.	.	.	.	.	.	.	.	1	.	.	1
560	.	.		.			.	.	.	1	.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 18. Northern Pike (Continued)

FORKLENGTH /A	1	2	3	4	5	6	7	8	9	10	11	13	TOTAL
						HABITAT							
NORTHERN PIKE CONT.													
8/01/85 TO 0115/2S													
60	.	.	.	.	.	.	.			1		.	1
70	.	.		.	.	.	.	.	.	4	.	.	4
80	.		.	.		1		.		2	.	.	3
s e	.	.	.		.	.	.	.	.	1	.	.	1
110	.	.	.	.			1			1		.	2
120	.	.	.	.	1		1	.	.	.	.	.	2
13s	.	.	.	.	1	.	.				.	.	1
340	.	.	.	.	.	.	.	.	.	1	.	.	1
350	.		.	.			.			1		.	1
360	.	.	.	.	.		.	.	.	1	.	.	1
378	.	.	.	.	.	.	.			1	.	.	1
380	.	.	.		.	.	.		.	1	.	.	1
40s	.	.	.	.		.	.			2		.	2
432	.	.	.	.	.	.	1	.	.	.	.	.	1
440	a	.	.	.		.	.			1		.	1
470	.	.	.	.	.	.			.	1		.	1
480	.	.		.		.	.			2	.	.	2
570	.	.		.	.	.	.		.	2	.	.	2
590	.	.	.	.		.	.			1	.	.	1
8/16/85 TO 8/31/85													
60	.	.	.	.	.		.			1	.	.	1
6 s	.	.	.	.	.	.	.	.		1	.		1
100	.	.	.	.			.			1	.	.	1
110	.	.	.		.	.	.		1	1	.	.	2
120	.	.	.	.			.		3	1	.	.	4
13s	.		.	.	.	.	.	.	5	1	.	.	6
142	.	.	.	.	.		.		2	.	.	.	2
150	.	.	.	.	.	.	.	.	2	.	.	.	2
1s2	.	.	.	.	.		.		1	.	.	.	1
6 s s	.	.	.		.	.		.	.	1	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 18. Northern P· ke (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	13	TOTAL
6/14/85 TO 9/18/85 NORTHERN PIKE													
20		.	.	.			1			.	.		1
30	.	.	.	.	.	.	.	.	i	.	.	.	1
60			.			.	.		.	2			2
7s	.	.		.	.	.	.	.	.	4	.	.	4
80		.	.	.		1	.		.	3			4
90	.	.	.	.	.		.	.	.	1	.	.	1
100	.	.	.	1	.	.	.		.	1		.	2
110		.	.		.	.	1	.	1	2	.	.	4
120		.			1	.	1	.	3	1		.	6
130		.	.	.	1	.	.		5	1	.		7
140	.			.	.	.		.	2	.	.	.	2
150		.	.	.	.	.	.	.	2	.	.	.	2
180	.			.	.	.	.	.	1	.		.	1
280	.	.		.		.	.	.		1	.		1
290	.				.	.		.	2				2
300	.	.					.	.	1	.			1
310		.		.	.	.		.	.	1	.	.	1
330	.					.	.	.	2	1		.	3
340	.			.	.	.	.	1	3	2	.	.	6
350	.						.	.	1	4		.	5
360	.			.	.	.	i	.	.	1	.	.	2
370	.			.	.		.	.	1	3	.	.	4
380	.	.	.	.	.	.	.	.	1	i	.	.	2
393	.	.		.	1	.	.	.	.	2	.	.	3
400	.	.	.	.	.	.	.	1	1	2		.	4
410	.	.		.	.	.	.	.	.	1	.	.	1
430	.	.	.	.	.	.	1		1	.	.	.	2
440	.	.	.	.	.	.	.	1	.	2	.	.	3
450		.	.	.	.	.	.	1	.	.	.		1
46s		.	.	.	.	.	.	1	1	.	.	.	2
479		.	.	.	.	.	.	.		1			1
480		.	.		.	.	.		.	2	.		2
490	.			.	.	.		.	1	.		.	1
510	.	.	.	.	.		.	1		.		.	1
530	.	.	.	.	1	.		.	.	2	.	.	3
560	.		.	.	1	.	.	.		1	.	.	2
578	.	.	.	.	.	.	.	.	.	2	.	.	2
590	.	.		.	.	.	.	.	.	1	.	.	1
610	.	.	.	.	.			.	.	i	2	.	3
620	.	.	.	.	.	.	.	1	.	1	.	.	2
630	.	.	.	.	.	.	.	.	.	1	.	.	1
64s	.	.	.	.	.	.	.	1	.	.	.	.	1
650		.		.			.	.	.	1	.		i
670	.	.	.	.	.		.	1	.	1	.	.	2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 19. Length Frequency of Catch by Habitat and Time Period for Burbot

	HABITAT												
FORKLENGTH A/	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
BURBOT													
6/14/65 706/XVK													
79	.	.	.		1	.	1		.	.		.	2
90	.	.	.	.	1	.	.	.			.	.	1
100	.	.	.	.	1	.			.	.	.	.	1
122	.		.	.	1	.	.	.					1
130	.	.	.	.	2	.	.	.	.	.	.	.	2
230	.		.	.	1		.	.			.		1
260	.	.	.	.	1	.	.	.	.		.	.	1
280	.	.	.	.	1		2	.	.	.	.	.	3
290	.	.	.	.	1	.	.	.					1
300	.	.	.	.	2	.	.	.	.	.	.	.	2
310	.	.		.	1		1	.	.	.	.	.	2
335	.	.	.	.	2	.			.	.	.	.	2
342	.	.	.	.	1	.	1	.	.	.	.	.	2
350	.	.	.	.		.	3	.	.	.			3
368	.	.	.			.	1		.	.		.	1
372	.	.	.	.	1	.	.	.			.	.	1
380	.	.					1		.	.		.	1
390	.		.	.	1		.	.			.		1
400	.	.	.		.	.	1	.	.		.	.	1
410	.	.	.	.	.	.	1	.	.	.		.	1
420	.	.	.	.	2	.	1	.			.		3
430	.	.	.	.	.		3	.	.	.	.	.	3
450	.	.	.	.	.	.	1	.			.		1
460	.	.	.	.	.	.	.	.	.	.	2	.	2
482	.		.	.	.		1	.	.	1	.		2
490	.	.		.	.	.	1		.	.	.	.	1
620	.	.	.	.	.		1	.	.	.	.	.	1
660	.	.	.	.	1	.	.		.	.	.	.	1
710	.	.		.	.		1	.	.	.	.	.	1
780	.	.	.	.	1	.	.		.	.	.	.	1
7/01/85 m 7115125													
20	.	.	.	.	.	.	71	.	.	.	.		71
39	.	.	.	.		3	110	.	.	.	.	.	113
40	.	.	.	.	.	.	8	.	.	1	.	.	9
80	.	.	.		1	.	.	.	.	.	.	.	1
110	.	.		.	.	.	1	.	.	.	.	.	1
230	.	.	.		1	.	.	.	.		.	.	1
272	.	.	.	.	.	.	1	.	.	.	.	.	1
280	.	.	.		1	.	.	.	.	.	.	.	1
330	.	.	.	.	1	.		.	.	.	.	.	1
440	.	.	.	.	1		.	.		.	.		1
672	.	.	.				.		.		1	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 19. Burbot (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	s	6	7	a	9	10	11	12	TOTAL
BURBOT CONT.													
7/16/85 TO 7/31125													
20	.	.	.	.	.	2	33	.	.	.	.	.	35
3 a	.		.		.	2	2$7	.	.	.	.	.	299
40	.	.	.	.	.	1	83	.	.	1	.		25
50	.		.		.	1	a	.	.	2			11
6 a	.			.	.		2	.	.	i	.		3
100	.	.	.		.	.	.		.	1	.	.	1
130	.			.	.		1	.	.	i	.	.	i?
3 0 a	.	.	.			.	1		.		.	.	1
4 2 a	.			.	.	.	1	.	.	.	.		1
4 4 a	.	.	.	.		.	1				.	.	i
8/01/85 70 8/15/25													
30	.	.	.				12		.	.	.		12
40	.		.	.	.	.	95	.		.	.	.	95
50	.	.	1	4	2	1	34		.	4	.		46
60	.	.	21	3	5	.	11	.	.	7		.	47
70	.	.	8	4	.	.	1			1		.	14
80	.	.	2	1	1	1		.	.	2		.	7
90	.		1	.	.			.	.	.		.	1
120	.		1	.	.			.	.	.	.	.	1
132	.	.	.	.	1	.	.			.		.	1
140	,	.	1	1	2		.	.	.	.		.	4
150	.	.	.	1	1	.	1	.		.			3
160	.		.	.	2	.	.	.	.	.		.	2
170	.	.	.	1	1			.	.	.		.	2
180	.		.	1	.	1	1	.	.	.	.	.	3
200	.	.	.	.	1	.	.	.	.	.		.	1
220	.			1	.	.	.	.	.	.	.	.	1
2 5 a	.	.	.	1	.			.	.	.	.	.	1
270	.				2	.	.	.	.	.	.	.	2
280	.		,	1	.			.	.	.	.	.	1
310	.				2	.	.		.	.	.	.	2
330	.			1	.	.	.	.	.	.	.	.	i
390	.	.	.	.	.	.	1	.	.	.	.		1
410	.	.	.	.	1	.	1	.	.	.	.	.	2
580	.	.	.	.	.	.	.	.	.	1	.	.	1
8/16/85 70 8/31/85													
5 a	.	.	1	.	.	.	1	.	.	4	.	.	6
6 a	.	.	2	.	4		.	.	.	18		.	24
70	.	.	.	3	.	.	.	.	.	11	.	.	14
80	.		3	3	1	.	.	.	.	.		.	7
90	.	.	1	.	3	.	.	.	.	.		.	4
100	.	.	1	.	.	.	.		.	2	.	.	3
110	.	.	.	.	1		.	.	.	1	.	.	2
140	,		.	.	.	.	.	.	1	.	.	.	1
150	,	.		1	.	.	.	.	.	.		.	1
160	.	.		1	1	.	.	.	.	.	.	.	2
170	,	.			.	.	.	.	1	1		.	2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX C

Table 19. Burbot (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
BURBOT CONT.													
8/16/8S TO 8/31/85 CONT.													
180	.	.	.		3	.		.	1	.		.	4
190	.	.	.	.	i	.	.	.	2	.	.	.	3
20a	.	.	.			.	.	.	2	.	.	.	2
210	.	.	.	1	.		1	.	.		.	.	2
410	.	.	.			.		.		1	.	.	i
420	.	.	.	.	.	.	.	.	.	1	.	.	,1
46a	.	.	.			.	.	.		1	.	.	1
470	.	.	.	.	.	.	.	.	.	2	.	.	2
570	.	.	.			.	.	.		i	.		i
63a	.	.	.	.	.	.	.	.	.	i	.		1
650	.	.	.				.	.	1	.	.	.	1
660	.	.	.	.	.	.	.	.	.	3	.	.	3
670	.	.	.			.	.	.		1	.	.	i
720	.	.	.	.	.	.	.		.	i	.	.	i
790	.	.	.	.	.	.	.	.	.	1	.	.	1
9/01/25 TO 9/18/2S													
50	.	.	.	.		.	1	.		.	.	.	1
60	.	.	1	.	.	1	1	.	.	2	.	.	5
70	.	.	.	1	.	4	1	.		4	.	.	10
20	.		.	.	.	5	.	.	.	3	.		8
90	.	.	.		.	.	.	.		1	.	.	i
lea	.		3	.	1	.	.		.		.		4
110	.	.	.	.	1		.	.			.		1
122	.		.		i	.	.	.	.	.	.		1
140	.	.	.	i	i	.	.		.	.	.		2
190	.	.	2	.	.	.	.	.	.	.	.	.	2
200	.		2	i	i	.	.		.		.		4
210	.	.	.	.	i	.	.	.	.	.	.	.	1
220	.		.	.	3	.	.		.		.		3
230	.	.			i	.	.	.	.	.		.	1
252	.		.	.	i	.	.		.	.	.		1
260	.	.	.	.	i	.	1	.	.	.	.	.	2
296	.	.	.	.	.	.	1		.	.	.		1
320	.	.	.			.	1	.	.	.			1
see	.		.	.	.	.	.	.	.	i	.	.	1
670	.	.	.			.	.	.	.	1	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 19. Burbot (Continued)

/A FORKLENGTH	1	i?	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/181S5													
BURBOT													
20	.			.	.	2	104	.	.	.			106
30		.	.	.	.	5	329	.	.	.	.	.	334
40	.				.	1	186	.	.	2		.	189
50		.	2	4	2	2	44	.	.	10	.	.	64
69			24	3	9	1	14		.	28		.	79
70		.	8	8	1	4	3	.	.	16	.	.	40
80		.	5	4	3	6		.	.	5		.	23
90	.	.	2	.	4			.		i	.	.	7
100		.	4	.	2	.	.	.	.	3	.	.	9
118	.	.		.	2		1	.		i	.	.	4
120		.	1	.	2		,	.	.	.	.	.	3
130	.	.	.	.	3		1	.	.	i	.	.	5
140	.	.	1	2	3	.	.	.	1	.	.		7
150		.		2	1	.	1	.			.	.	4
160	.	.		1	3			.	.	.	.	.	4
170	.		'	1	1	.		.	1	1	.	.	4
180	.	.	.	1	3	1	1	.	1	.	.	.	7
190	.		2		1	.			2		.		5
200	.	.	2	1	2		.	.	2	.	.	.	7
210	.	.		1	1	.	1		.	.	.	.	3
220	.	.	.	1	3	.	.	.		.	.	.	4
230	.				3	.			.	.	.	.	3
250	.	.	.	1	1	,	.			.	.	.	2
260	.				2		1	.	.	.	.		3
270		.		.	2	.	1				.	.	3
280	.			1	2	.	2	.	.	.			5
'29a		.	.	.	1	.	i		.		.	.	2
300				.	2	.	1	.	.	.	.	.	3
310	.			.	3	.	1		.		.	.	4
320	.	.	.	.	.	.	1	.	.	.	.	.	i
330	.			1	3	.			.	.	.		4
340		.		.	1	.	1	.	.	.	.	.	2
350	.				.	.	3	.	.	.	.		3
360	.	.	.	.	.	.	1	.	.	.		.	1
370	.	.	.	.	1	.	.	.	.	.	.		i
380			.	.	.	.	1	.	.	.	.	.	i
390	.	.	.	.	1	.	1	.	.	.	.		2
400		.	.	.	.		1	.		.	.	.	i
410		.	.	.	i	.	2	.	.	i			4
42a		.	.		2		2		.	i	.	.	5
432		.	.	.	.	.	3		.	.	.		3
442		.	.	.	1	.	1	.	.	.	.	.	2
450	.	.	.	.	.	.	1	.	.	.		.	1
460	.	.	.	.	.	.	.	.		i	2	.	3
478		.	.	.	.		.	.	.	2		.	2
480		.	.	.	.	.	1		.	1	.	.	2
490		.	.	.	.		1	.	.	.		.	1
500		.	.	.	.	.				i	.	.	i
570		.	.	.	.		.	.	.	i	.	.	i
520	.	.			.	.		.	.	i	.	.	i
620		.	.	.	.		1						1
630			.		.			.		"1			i
650					.		.	.	1		.		i
660		.	.		1	.	.	.		3			4
678		.		.	.			.		2	i	.	3
718		.			.		i					.	i
780		.			1		.	.		i			2
7$3			.		.	.	.			i		.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. S. 30=30 TO 39 MM)

APPENDIX C

Table 20. Length Frequency of Catch by Habitat and Time Period for Blackfish

FORKLENGTH /A	HABITAT 1	2	3	4	s	6	7	8	9	10	11	13	TOTAL
BLACKFISH													
6/14/S5 TO 6/30/S5													
6s	.		.	.		.	1	.	.	.	.	.	1
70	.	.	.	.	.		.	.	.	2	.	.	2
7/01/85 TO 7/15/85													
70	.		.		.	.	.	.	.	1		.	1
80	.		.				.	.	.	1	.		1
7/16/85 TO 7/31/85													
90	.	.	.	.	.	.	.	.		1		.	1
8/01/85 TO 8/15/85													
50	.	.	.	.	.	.	. .	.	.	1	.		1
6s	.	.	.	.	.		.	.	.	11		.	11
70	.	.	.	.	.	.	.	.		2		.	2
2s	.	.	.	.	.	.	.	.	.	7		.	7
90	.	.		.	.	.				1			1
100	.	.	.	.	.	.	.	.	.	3		.	3
8/16/85 TO 8/31/85													
50		.			.	.				2	.		2
6a	.	.	.	.		.	.	.	.	0		.	8
70	.	.		.	.	.	.		.	7	.	1	8
80	.	.		.		.	.	.	.	4		1	5
90		.	.	.	.	.		.	.	4		7	11
100	.		.			.	.	.		2	.	a	10
110		.		.	.	.		.	.	2	.	7	9
12s	.		.	.		.	.	.	.	.	.	7	7
13s		.		.	.	.			.	.	.	2	2
140	.	.	.	.		.	.	.	3		.	3	6
150	.	.		.	.	.		.	5	.		2	7
16s	.	.	.	.		.	.	.	1		.	1	2
9/%1/25 TO 9/18/25													
80	.	.	.	.	.	.	.	.	.	1	.	.	1
%.	.	.	.		.	.	.	.		1		.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 20. Blackfish (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	S	6	7	8	9	10	11	13	TOTAL
6/14/85 TO 9/16/25													
BLACKFISH													
50	.	.		.	.	.	.	.	.	3	.	.	3
60	.		.		.	.	1	.		19	.	.	20
70	.	.	.	.	.				.	12	.	1	13
80			.	.	.	.	.	.		13	.	1	14
92	.		.	.	.					7	.	7	14
100				.	.	.	.	.		s	.	8	13
110			.	.	.	.	.			2	.	7	9
120	.	.		.		.	.	.				7	7
130	.	.		.	.	.	.	.			.	2	2
140	.	.			.				3		.	3	6
150	.			.		.	.		3			2	7
160			.	.	.	.		.	1		.	1	2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 21. Length Frequency of Catch by Habitat and Time Period for Trout-Perch

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	13	TOTAL
TROUT-PERCH													
6/14/85 TO 6/30/85													
40	.	.	.	.	.	.	1	.	.	.	.	.	i
7/81/85 TO 7115/65													
30,	.	.	.	.	.	.	.	.	.	6	,	.	6
44	.	.	.	.	.	.	.	.	.	2	.	.	2

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	13	TOTAL
6/14/85 TO 9/10/85													
TROUT-PERCH													
3a	.	.	.	.	.	.	.	.	.	6	.	.	6
4a	.	.	.	.	.	.	1	.	.	2	.	.	3

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 22. Length Frequency of Catch by Habitat and Time Period for Starry Flounder

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
STARRY FLOUNDER													.
6/14/85 TO 6/?3/65													
30	.		.	.	1		1		.	.	.	.	2
40	.			.	I	.		.	.	.			1
70	.	.			1				.	.	.		1
100	,		.	.	1	.		.	.		.	.	1
110	.	.	.	.	1	.	1	.	.	.	.		2
120	.		.	9	3		1	.	.			.	13
130	,	.		2	i		i		.		.	.	4
140	.			3	3	.		.	.			.	6
159	.		.	2	.		.	.	.		.	.	2
160	.		.	2	1	.	1	.	.			.	4
170	.	.	.	3			.	.	.	.	.	.	3
190	,			.	i	.		.	.			.	1
210	.		1				.	.	.	.	.	.	1
220	.			1	.	.	1	.	.		.	.	i?
7/01/85 TO 7/15/2S													
110	,	.	.	2	.		.		.	.	.	.	2
120	.		.	2			.	.	.		.	.	i?
130	.	.	.	1	.	.			.	.	.		1
150	.		.	1		.	.	.	.	.	.		1
160	.	.	.	i	.	.	.		.	.			1
170	,	.	.	1			.	.	.	.	.	.	1
180	.	.	.	1	.	.	.		.	.	.		1
190	,		.	2		.	.	.	.	.	.	.	2
7/16/85 TO 7/31/85													
70	,	.	.	.	1	.	3		.	.			4
6 0	.	.	.	1	.	.	.		.	.	.		1
90	.	.		i	.	.		.	.	.		.	1
110	.	.	.	1	.	.	.		.	.	.		I
120	.	.		4	.	.		.	.		.	.	4
130	.	1	.	5	3	.		.	.	.		.	9
140	.		.	14	6	.	1	.	.		.	.	21
150	.	.	.	13	11	.		.	.	.	.	.	24
160	,		.	5	1		.	.	.	.	.	.	6
170	.			6	5	.	,	.	.	.	.	.	11
180	.	.	.	4	3		.	.	.	.	.	.	7
190	,		.	2	1	.	.	.	.	.	.	.	3
2 0 0	.	.	.	2	3		.	.	.	.	.	.	5
210	,		.	.	1	.	.	.	.	.	.	.	1
230	.		.	1	.		.		.	.	.	.	1
24a	,	.	.	1			.	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 22. Starry Flounder (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
STARRY FLOUNDER CONT.													
8/01/85 TO 8/15/85													
50	.	.		1	.	.	.	.			.	.	1
60	.		.	1	.		.	.	.	.	.		1
70	.	.	.	1	.	.	.	.			.		1
80	.	.	1	2	1	.	1	.	.		.	.	5
9 a	.		.	3	.		1	.		.	.		4
100	.			3	.	.		.	.			.	3
110	.		.	3	.		.			.	.	.	3
120	.	.	.	6	.	.	.	.	.	.	.	.	6
130	.	.	.	5	2	.	.		.	.	.	.	7
140	,	.	1	6	2	.	.			.	.	.	9
150	.		.	8	6		.		.	.		.	14
160	.	.	.	6	2	.	.	.			.		8
170	.		.	3	2		.	.	.				5
180	.	.	.	2	1	.	.			.	.	.	3
190	.		.	.	3			.	.	.			3
210	.		.	1			.		.	.			1
220	.		.	2		.		.	.		.		2
230	.		.	1			.		.	.	.		1
250	.	.	.		i	.		.			.	.	1
8/16/25 TO 8/31/6S													
80	.	.	.	1	.		.	.		.	.	.	1
90	.	.	.	3	.	.	.	.	.		.	.	3
100	.	.	.	B	.	.	.	.	.	.	.	.	8
110	.	.	.	4	.	.	.	.			.	.	4
130	.	1	.	4	.		.		.	.	.	.	5
140	.	.	.	4	.	.	.	.		.	.	.	4
150	,	.		5	J		.		.	.			6
160	.	.	.	16	.	.	.	.		.	.	.	16
170	,	.	.	11	3		.	.	.	.	.		14
180	.	.	.	2	1	.	.	.	.	.	.	.	3
190	.	.		3			.	.	.	.		.	3
200	.	.	.	3	.	.	.		.	.			3
210	,			4	.			.	.	.	.	.	4
220	.	.	.	3	.	.	.	.	.	.			3
230	.	.	.	1	.	.	.	.	.	.	.	.	1
9/91/65 TO 9/18/85													
110	.	.	.	.	1	.	.	.	.		.	.	1
132	.	.	.	2	.	.		.	.	.	.	.	2
140	.	1	1	.	.	.	.	.		.	.	.	2
150	.	.	.	2	.	.	.	.	.	.	.	.	2
160	.	1	.	1	.	.	.	.		.	.	.	2
180	.	.	.	1	1	.	.	.	.		.	.	2
190	.	.	.	1	.	.	.		.	.	.		1
220	.	.	.	.	2	.	.	..	.		.	.	2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 22. Starry Flounder (Continued)

/A FORKLENGTH	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85 STARRY FLOUNDER													
3 .	•	•	•	•	1	.	1	•	•	•	•		2
4 $	.	.	.		1	.	,	•	•	•	•	•	1
s e	•	•	•	1	.	.	,	•	•		•		1
6 4		. ,	0	1	.	.	.	•	•	•	•		1
70.		.	.	1	2	•	3		•			•	6
S O	,		1	4	1	.	1	•	•			•	7
53	.	.	.	7	•	•	1	•		•	•	•	8
100	.	.	.	11	1	•	.		•			•	12
110	.	.	.	10	2	•	1		•	•	•	•	13
120	.	.	.	21	3	.	1			•		•	25
130	.	2	.	19	6	.	1	•			•		28
140	.	1	2	27	11	.	1	•	•	•	•		42
150	.	.	.	31	18	.	.	•	•		•	•	49
160	.	1	.	31	4	•	1	•			•		37
170	.	.	.	24	10	.	.					•	34
180	.	.	.	10	6	.	.	•	•			•	16
1 9 0 .	•	•	•	8	5	•	.	•		•		•	13
. ? 3 2	,	.	,	5	3	•	.					•	8
210	.	,	1	5	1	•	.	•	•	•	•	•	7
22%	.	.	.	6	2	.	1		•	•	•	•	9
2 3 2		.	. .	3	.	.	.		•	•		•	3
240	,	.	,	1	.	.				•	•	•	1
m.		.	.	.	1	.		•	•	•		•	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 23. Length Frequency of Catch by Habitat and Time Period for Arctic Flounder

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ARCTIC FLOUNDER													
6/14/85 TO 6/30/85													
40	.	.	.	1	.		.	.	.	.	.	.	1
5a	.	.	.	28	.	.	.	.	.	.	.	.	2a
60	.	.	.	39	.			.	.	.		.	39
100	.		.	2	.	.	.	.	.	.	.		2
110	.	.	.	2	.	.	.	.	.	.	.		2
120	.			1	.	.	.	.	.	.	.	.	1
132	.	.		1	.	.	.				.		1
140	.	1	.	.			.	.	.	.	.	.	1
7/01/85 To 7/15/85													
150	.	.	.	1	.	.	.	.	.	.	.	.	1
7/16/85 TO 7/31/85													
2a	.	.	.	.	23		.	.	.	.	.	.	23
30	.	.	.	.	23		.	.	.	.		.	23
60	.	2	.	.	a			.	.	.		.	10
70	.	1	.	.	18	.	.		.	.	.		19
80	.		.		23	.	.			.	.		23
90	.	.	.		4	.	.	.	.	.	.	.	4
100	.				2	.	.	.	.	.	.		2
110	.	2	.	13	8		.	.	.	.	.	.	23
12a	,	.		a	5	.	.	.	.	.	.	.	13
130	.	.	.	6	4	.			.	.	.	.	10
140	.	2	.	17	$			.	.	.		.	24
150	.	.	.	9	5	.	.		.	.	.	.	14
160	.	1	.	3	2	.	.	.	.	.		.	6
170	.	1	.	3	4	.	.	.	.		.		8
180	.		.	4	i?	.	.			.	.		6
190	,	.	.	4	2	.	.	.	.	.	.	.	6
200	.	.		z	1	.	.	.	.	.	.		3
8/01/85 TO 8/15/85													
20	.	.	.	.	.	.	1	.	.	.		.	1
50	.		1		.	.	.	.	.	.	.		1
60	.		7	.	.		.		.	.	.		7
70	.	.	19		.	.	.	.	.	.	.	.	19
80	.	.	27		1	.	.	.	.	.	.	.	2a
90	.	.	6	.			.	.	.	.	.	.	6
110	.	.	4	.	.	.	.	.	.	.	.	.	4
120	.		5	.	.	.	.	.	.	.		.	5
130	.	2	4	1			.	.	.	.		.	7
14a	.	4	7	1	.	.	.		.	.	.		12
150	.	5		.	.	.	.			.	.		5
160	,	3	1	2	.	.	.	.	.		.	.	6
170	,	1	.	3	.	.	.	.	.		.	.	4
180	1	1	2	1	.		.	.	.	.	.		5
190	.	.	1	1	.	.	.	.	.	.	.	.	2
200	1		.	.	.	.				.			1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 23. Arctic Flounder (Continued)

/A FORKLENGTH	1	i?	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
ARCTIC FLOUNDER CONT.													
8/16/85 TO 8/31/85													
M	.	.		1	.	.	.	.	.	.	.	.	1
50	.	.	.	.	7	.	.	.	.	.	.	.	7
60	.	.	1	.	1	.	.	.	.	.	.	.	2
70	.	.		4	.	.	.	.	.		.	.	4
80	.	.	2	9	3	.			.	.	.	.	14
9 a	.	.	.	7	3	.	.	.	.	.	.	.	10
100	.	.	1	2	4	.	.		.		.	.	7
110	.	.	.	7	2	.	.	.	.	.	.		9
120	.	.	2	8	.	.	.	.	.		.	.	10
13a	,	.	8	8	.	.	.	.	.	.	.		16
140	2	.	4	7	2	.	.	.	.	.	.	.	15
150	,	1	13	15	2	.	.	.		.		.	31
160	,	1	4	7	6		.	.	.	.		.	18
170	4	.	2	2	3	.	.		.		.	.	11
120	.		2	6	3	.	.	.		.	.	.	11
190	.		1	4	3	.	.		.		.	.	a
9/81/6S TO 9/18/25													
2 2	.		.	1	.	.	.				.		1
30	.	.	.		22	.	.	.		.	.	.	22
40	.	.	.	6	20	.	.	.		.	.		26
50	.	1		4	S		.	.		.		.	10
70	,	1	.	.	.	.	.	.		.	.	.	1
90	.	1	.	1			.	.		.		.	2
100	.	2	.	i	.		.	.		.	.	.	3
110	.	.		1		.	.	.		.		.	1
126	.	.	.	i	.		.	.		.	.	.	1
130	.	3		.	.	.		.		.	.	.	3
149	.	4	.	1	.		.	.		.		.	5
150	.	.	.	1		.	.	.		.	.	.	1
170	.	1	.	.	.	.	.	.		.		.	1
120	.		.	1	1	.		.		.	.	.	2
190	.	1	.		..	.	.	.		.		.	1
200	.	1		.	.	.		.		.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 23. Arctic Flounder (Continued)

/A FORKLENGTH	HABITAT i	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/S5 TO 9/18/2S ARCTIC FLOUNDER													
20	.	.	.	1	2 3	.	1	.	.		.	.	25
W.	.		.	.	45	.	.	.		.		.	45
‘w	.	.	.	8	2 8	.	.		.		.	.	28
50	.	1	1	32	12	,	.	.		.	.	.	46
60	.	2	8	39	9	.	.		.			.	5s
70	.	2	19	4	18	.	.	.	.	.			43
se.		.	29	9	27	.	.		.	.		.	65
90	.	1	6	8	7	.		.	.			.	22
100	.	2	1	5	6	.	.	.	.	.		.	14
110	.	2	4	23	10	.		.	.	.	.		39
120	.	.	7	18	5	.	.	.		.		.	30
13s	.	5	12	16	4	.	.	.	.	.	.		37
140	2	11	11	26	7	.	.	.					57
15s	.	6	13	26	7	.		.	.	.	.		52
16s	.	5	5	12	B	.	.	.	.	.	.		30
170	4	3	2	8	7	.	.	.	.	.	.	.	24
180	1	1	4	12	6	.	.	.	.	.	.		24
190	.	1	2	9	5	.	.	.	.		.	.	17
200	1	1	.	2	1	.		.	.	.	.	.	5

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 24. Length Frequency of Catch by Habitat and Time Period for Arctic Saffron Cod

/A FORKLENGTH	HABITAT 1	i!	3	4	s	6	7	8	9	10	11	12	TOTAL
SAFFRON COD													
6/14/25 TO 6/3%/2S													
190	.	.	.	1	.		.	.	.	.	.		1
230	.	.	1	.			.		.	.	.		1
240	.	.	.	.	1	.	.	.		.	.		i
2 6 0	.	.	1	.	s	.	.	.	.	.	.	.	1
300	.	.	1	.	.	.	.	.	.	.		.	1
7/16/25 TO 7/31/25													
110	.	1	.	.	.	.	.		.	.	.		1
120	1	.	.			.	.	.	.		.		1
132	i	.	.	.	.	.	.	.	.	.	.	.	i
220	1		.		.		.	.	.	.	#	.	1
260	.	.		.	1	.	.	.	.	.	.	.	1
8/01/2S TO 8/15/8S													
50	8	.	.	.		.			.		.	.	8
60	81	.	1	.	.	.	.	.	.	.	.	.	22
70	19	.	5	.				.	.	.	.		24
80	7	.	4	.		.	.	.	.	.	.	.	11
92	1	.	1	.	.	.	.	.		.	.	.	2
100	2		1			.			.	.	.	.	3
110	10	.	.	.	.	.	.	.		.	.	.	10
120	9	.	.	1	.		.	.		.	.	.	10
13a	7	.	.	.	.	.	.	.	.	.	.	.	7
140	1	.	.	.	.	.	.	.	.	.		.	1
150	1	.	1		.	.			.		.	.	2
160	2	.	.	.	.	.	.	.	.	.	s	.	2
242	2	.	1	.	.	.	.	.	.	.	.		3
26a	2		.			.		.	.	.	.		2
290	.	.		1	.	.	.	.	.	.	.	.	1
300	.	.		1	.	.	.	.	.	.	.	.	1
8/16/25 TO 6/31/65													
62	9	.	2			.	.		.	.	.	.	11
72	22	.	2	.	.	.	.	.	.	.	.	.	24
80	1		.	.	.	.	.		.	.	.	.	1
130	4		.		.	.			.	.	.	.	4
140	3	.		.	.	.	.	.	.	.	.	.	3
210	.			.	1	.	.	.	.	.	.	.	1
230	.	.	.	.	1	.		.	.	.	.	.	1
242	,	.	.	1	4		.	.	.	.	.	.	s
250	.	.	.	.	10	.	.	.	.	.	.	.	10
260	.	.	.	.	12	.	.	.	.	.	.	.	12
270	1	.	.	1	12	.	.	.	.	.	.	.	14
280	.	.	.	1	14	.	.	.	.	.	.	.	15
2 2 2	.	.	.	.	9	.	.	.	.	.	.	.	9
300	.	.	.	.	3		.	.	.	.		.	3
310	.	.	.	.	2	.	.	.	.	.	.	.	2
320	.	.	.	.	1	.		.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C
Table 24. Saffron Cod (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
SAFFRON COD CWT. 9/01/85 TO 9118/85													
70	26.		.	.	.	.	.	.			.		26
80	62.		,	.		.		.		.	.	.	62
90	21	.	.		.	.	.	.	.		.		21
lee	1	.	.	.	.	.	.	.		.			1
110	1	.	.	.	.	.	.	.		.		.	1
130	.	.	1		1	.	.	.	.		.		2
148	.	.	2	3	.		.	.	.	.	.	.	5
150	.	.	3	.	.	.	.	.			.		3
160	.		1	1	.	c	.	.	.	.	.	.	i?
170	.	.	3	1	.	.		.	.	.	.	.	4
188	.	.	4	i					.	.	.	.	5
190	.	.	1	.			.	.	.	.	.	.	1
200	.	.	2	1	1	.				.	.	.	4
210	.	.	1	.	.			.	.		.	.	1
228	.	.	8	1	2	.	.	.				.	11
238	.	.	1	1	3	.			,	.	.	.	5
240	.	.	1	5	7	.	.	.			.	.	13
250	.	.	7	6	17				.	.		.	39
268	.	.	5	13	15	.	.	.	.		.		33
270	.	.	3	11	16	.	.	.			.		30
280	.	.	5	14	17	.	.	.	.	.	.		36
290	.	.	4	9	12	.	.	.			.	.	2s
300	.	.	2	4	14	.	.	.	.	.	.	.	20
310	.	.	3	4	9	.	.	.	.	.	.		16
328			1	i	6			.	.	.	.	.	8
330	.	.	1	1	.	.	.	.	.	.	.	.	2
348	.		.	2	2		.	.	.	.	.	.	4
350			.		1	.	.	.	.	.	.	.	1
380	.			.	1		.		.	.	.	.	1
390			.	2		.	.	.	.	.	.		2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 3%38 TO 39 MM)

APPENDIX C
Table 24. Saffron Cod (Continued)

FORKLENGTH /A	1	2	3	4	5	HABITAT 6	7	8	9	10	11	12	TOTAL
6/14/25 TO 9/18/2S													
SAFFRON cull													
50	8	.	.	.		.	.	.					8
60	90	.	3	.			.			.	.	.	93
70	67		7	.			.	.			.	.	74
80	70		4		.		.	.	.		.	.	74
90	22		1	.		.	.		.	.	.	.	23
100	3	.	1	.	.		.				.	.	4
110	11	1		.		.	.	.		.	.	.	12
120	10	.		1	.	.	.	.		.	.	.	11
132	12		1		1		.		.		.		14
140	4	.	2	3		.	.	.		.	.	.	9
150	1		4	.			.		.	.	.	.	5
160	2		1	1	.						.	.	4
170			3	1			.			.	.		4
180	.	.	4	1	.		.					.	5
190	.		1	1							.		2
200		.	2	1	1		.	.	.				4
210	.	.	1	.	1		.				.		2
220	1	.	8	1	2		.	.	.				12
230		.	2	i	4		.						7
240	2		2	6	12	.		.	.	.	.	.	22
250	.	.	7	6	27	.	.	.	.				40
260	2	.	6	13	28	.			.	.	.	.	49
270	1		3	12	2a	.			.				44
280	.		5	15	31	.		.		.	.	.	51
290			4	10	21	.		.	.	.			35
300	.	.	3	5	17	.				.	.	.	25
31'3		.	3	4	11			.		.			18
320	.		1	1	7			.	.	.	.		9
330	.	.	i	1	.	.		.	.		.		2
340				2	2		.		.	.	.	.	4
350	.	.	.		1			.	.	.	.	.	1
324				.	1					.	.	.	1
390	.	.	.	2	.	.	.	.	.	.	.		2

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 25. Length Frequency of Catch by Habitat and Time Period for Fourhorn Sculpin

FORKLENGTH /A	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
FOURHORN SCULPIN													
6/14/85 TO 6/30/85													
6 0	.		.		1	.	.	.	.			.	1
210	.	1	.	.	.	.		.	.	.		.	1
8/01/85 TO 8/15/2S													
30	.	.	.	.	1	.		.	.	.		.	1
50	.	.	2	.		.	.		.	.	.	.	i?
80	.	.	1	.		.	.	.	.	.	.	.	1
90	.	.	9		.	.	.	.	.	.	.		9
100	.	1	8	.	.	.	.		.	.	.		9
110	.	1	1	.	.	.	.		.	.	.	.	2
120	.	.	3		.	.	.	.		.	.		3
130	.	.	2	.	$	.	.	.	.	.		.	2
140	.		1	.	.	.	.	.	.		.	.	1
180	.	.	1	.	.	.	.	.	.	.		.	1
190	.	1	.	.	.	.	.	.	.	.		.	1
200	1	.	1	.		.	.		.	.	.	.	2
230	.	.	.	.	.	.	1	.	.	.	.	.	1
8/16/2S TO 8/31/85													
40	.	.	1		.	.	.		.	.	.	.	1
2 $	.		1	.	.	.		.	.	.	.		1
? 3	.		5	.	.	.	.		.	.	.		5
100	.	.	22	.	.	.		.	.	.		.	22
110	.	1	11		.	.	.	.		.	.		12
120	.	.	5	.	.	.	.	.	.	.		.	5
130	.	.	2	.	.	.	.	.			.	.	2
140	.	.	1	.		.	.	.	.	.	.	.	1
150	.	.	4	.	.	.		.	.	.		.	4
170	1	.	1	.			.		.	.	.	.	2
180	.	.	1	.	.	.		.	.	.		.	1
190	.	.	2	.	.	.	.		.	.	.	.	2
200	.	1	.	.		.	.	.	.	.	.	.	1
9/01/8S TO 9/18/2S													
2 a	.	.		.	1	.	.	.	.	.	.	.	1
9 3	.	1	.	.	.	.	.	.			.		1
100	.	i	.		.		.		.	.	.		1
110	.	4	.	.	.	.		.	.	.	.	.	4
120	.	3	.	.	.	.	.	.	.	.	.		3
140	.	4	.	.		.		.	.	.		.	4
150	.	2	.	.	.	.	.	.		.	.	.	2
170	.	1	.	.		.	.	.		.	.	.	1
180	.	.	.	1	.	.	.	.		.			1
190	.	1	.	.	.		.	.	.	.	.	.	1
2 0 0	.	1	.	.	.	.	.	.		.	.	.	1
220	.	1	.	.	.	.	.			.	.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 25. Fourhorn Sculpin (Continued)

/A FORKLENGTH	HABITAT 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/SS													
FOURHORN SCULPIN													
30	.		.	.	1	.	.	.	.	.	.		1
40	.	.	1	.	.	.	.		.	.	.	.	1
50	.	.	2	.	.	.	.		.	.	.	.	2
60	.	.	.	.	1	.			.	.	.	.	1
52.		.	2	.	1	.			.		.	.	3
90	.	1	14	.	.	.	.	.		.	.	.	15
100	.	2	3	.	.	.	.	.		.	.		32
110	,	6	12	.	.	.	.	.			.	.	18
120	.	3	8	.	.	.	.	.				.	11
130	.	.	4	,	.	.	.	.	.	.	.		4
140	.	4	2	.	.	.	.	.	.	.	.		6
150	.	2	4	.	.	.	.					.	6
170	i	1	1	.	.	.						.	3
180	.	.	2	1	.	.		.	.	.			3
190	.	2	2	,	.	.		.	.	.	.		4
200	1	2	1	.	.	.	.			.		.	4
210	.	1	.	.	.	.	.		.	.		.	1
2 2 0	.	1	.	.	.	.		.	.	.			1
239.	.	.	.		.	.	1	.	.	.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 26. Length Frequency of Catch by Habitat and Time Period for Pacific Herring

						HABITAT							
FORKLENGTH /A	1	2	3	4	5	6	7	a	9	10	11	12	TOTAL
PACIFIC HERRING													
6/14/25706/30/25													
190	1	.	.	.		.	.	.	.		.	.	1
252	1			.	.		.		.	.		.	1
7/16/25 TO 7/31/25													
50	1	.	.	.	.	.		.	.		.	.	1
60	1	.	.	.			.	.	.			.	1
70	2	.	.	.	.	.		.		.			2
80	15	.		.	.	.	.	.	.			.	15
90	55	.	.	.	.	.		.	.	.	.	.	55
100	44	.		.	.	.	.	.	.			.	44
110	18	.	.	.	.	.		.		.	.		18
120	4	.		.		.	.	.	.		.		4
130	5	.	.		.	.		.	.	.	.		5
142	7	.		.		.	.	.	.	.	.		7
150	7	.	.		.					.	.		7
162	3	.	.	.		.		.	.		.	.	3
170	1	.	.	.	.	.	.		.	.	.		1
180	1	.	.	.	.	.		.	.	.	.	.	1
200	1	.	.		.	.	.			.	.		1
8/01/85 TO 8/15/05													
80	2		.		.		.	.		.	.	.	2
90	1	.	.	.	.	.		.	.	.	.		1
100	5		.		.		.	.	.	.	.	.	5
.9/16/2S TO *8/31/25*													
110	1				.	.	.	.	.	.	.	.	1
130	1		.		.		.	.	.	.	.	.	1
9/61/25 TO 9/18/25													
30	1	.	.	.	.	.		.	.		.		1
50	1	.		.		.	.	.	.	.	.	.	1
90	1			.	.		.	.	.		.	.	1
100	1	.	.	.		.	.	.	.	.	.	.	1
110	4	.	.	.	.	.	.		.	.	.	.	4
120	7	.	.	.		.	.	.	.		.	.	7
130	4	.	.	.	.	.	.	.	.	.	.		4
140	1	.	.	.	.	.	.	.	.		.		i
152	1	.	.	.	.		.	.		.	.	.	1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E.G. 30=30 TO 39 MM)

APPENDIX C

Table 26. Pacific Herring (Continued)

FORKLENGTH /A	HABITAT 1	2	3	4	S	6	7	8	9	10	11	12	TOTAL
6/14/85 TO 9/18/85 PACIFIC HERRING													
30	1	.	.	.	.		.	.	.		.	.	1
50	2	.	.		.	.	.		.		.	.	2
60	1	.		.	.	.	.	.	.	.	.	.	1
70	2		.		.			.			.	.	2
80	17	.	.						.		.		17
90	57	.	.				.	.			.	.	57
100	50		.	.	.	.				.	.		50
110	23	.		.	.			.	.	e	.	.	23
120	11	.		.					.	.		.	11
130	10	.	.	.	.	.					.	.	10
140	8				.	.			.	.	.	.	8
150	a	.	.		.						.	.	8
160	3				.		.		.		.		3
170	1	.	.							.	.	.	1
12a	1		.					.			.		1
1s9	1	.	.		.						.	.	1
200	1	.	.	.	.	.				.			1
250	1				.		.			.	.		1

A/ FORKLENGTH DENOTES BEGINNING OF LENGTH INTERVAL (E. G. 30=30 TO 39 MM)

APPENDIX D

STOMACH COMPOSITION

APPENDIX D

Table 1. Chinook Salmon Stomach Composition

SPECIES 8755010206-ONCORHYNCHUS TSHAWYTSCHA CHINOOK SALMON

FROM COLLECTIONS	FILE ID.	SAMPLE NO.	STATION	LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
	85JN16	BH1		30701	6	0
	85JN25	W 1		30301	3	1830

LIFE HISTORY STAGE
9 JUVENILE

TOTAL SAMPLE SIZE 9

NUMBER OF EMPTY STOMACHS 3
PERCENTAGE OF EMPTY STOMACHS 33.33
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 6

PREY CODES TRUNCATEO BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.0.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.7	2.-6.	1.9
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.3	3.-5.	.8
TOTAL CONTENTS WEIGHT (GRAMS)	.01	NEG. - .04	.02
TOTAL CONTENTS ABUNDANCE (NUMBERS)	13.8	1.0- 39.0	19.1
NO. PREY CATEGORIES (PER STOMACH)	1.3	1.= 3.	.8
LENGTH (MM)	65.4	38.-	20.22
WEIGHT (GRAMS)	3.07	.3:: " 6.50	2.46
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.44	.O1- .99	.41

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

PREY ORGANISM PARTS COOE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S .0. *	BIOMASS $ TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S .D. *	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUN- DANCE	PERCENTAGES B1OMASS	PERCENTAGES NORM BIOMASS
SADURIA ENTOMON	7-JUVENILE	33.3	75	12.5	37- 38	19.4	.09	.01	.04- .05	.02	.0012	.0002	90.36	79,67	80.65
PLECOPTERA	H-NYMPH	16.7	1	.2	1-	.4	.01	.00	.O1- .01	.06	.0112	.0000	1.20	9.99	10.13
DIPTERA-CHIRONOMIDAE	6-LARVA	33.3	2	.3	1- 1	1 .5	,00	.00	NEG. - .00	.00	.0012	.0008	2.41	2.06	2.08
DIPTERA-CHIRONOMIDAE	8-ADULT	16.7	1	.2	1- 1	.4	.00	.00	NEG. - NEG.	.00	.0006	.0000	1.20	.64	.64

Table 1. Chinook Salmon (Continued)

SPECIES 8755010206-ONCORHYNCHUS TSHAWYTSCHA CHINOOK SALMON

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM BIOMASS
PLANTS ANO PLANT PARTS	Ø-UNSTAGED	33.3	4	.7	1- 3	1.2	.01	.00	NEG.- .01	.00	.0013	.ØØ15	4.82	6.61	6.60
UNIDENTIFIED MATERIAL							.00	.00	.aO- .00	.00				1.34	

TOTAL NUMBER OF PREY CATEGORIES 5

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS .63

BIOMASS 1.ØØ

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS .55

APPENDIX D

Table 2. Chum Salmon Stomach Composition

SPECIES 8755010202-ONCORHYNCHUS KETA CHUM SALMON

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION	LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
85JN17	P 1		30601	5	0
85JN19	P 1		30602	8	1956
85JN20	BH2		30703	11	0
85JN21	P 1		30101	3	1319
85JN21	P 2		30101	2	1427
85JN22	BH1		30704	9	1604
85JN23	W 1		30506	5	1820
85JN25	P 1		30202	6	1622
85JN25	P 1		30603	7	1222
85JN28	BH1		30708	5	0
85JN30	P 1		30201	10	1717
85JY07	BH1		30708	3	1040
85JY17	P 1		30601	4	1400
85JY21	P 2		30602	2	1650
85AU15	BH1		30708	2	1407

APPENDIX D

Table 2. Chum Salmon (Continued)

SPECIES 8755010202-ONCORHYNCHUS KETA CHUM SALMON

LIFE HISTORY STAGE 82 JUVENILE

TOTAL SAMPLE SIZE 82

NUMBER OF EMPTY STOMACHS 13
PERCENTAGE OF EMPTY STOMACHS 15.85
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 69

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	4.2	2.-7.	1.5
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.4	2.-6.	.9
TOTAL CONTENTS WEIGHT (GRAMS)	.01	NEG.-.10	.02
TOTAL CONTENTS ABUNDANCE (NUMBERS)	18.6	1.0-115.0	25.9
NO. PREY CATEGORIES (PER STOMACH)	3.1	1.-8.	1.9
LENGTH (MM)	46.0	35.-	7.89
WEIGHT (GRAMS)	1.72	.2:: “ 79.10	8.67
PCT RATIO OF CONTENTS WT TO PREDATOR WT	1.68	.00-9.01	2.29

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
ARANEAE	C-J/A NOSEX	1.4	1	.0	1-1	.1	.00	.00	.00-.00	.04	.0013	.0000	.08	.15	.16
ACARINA	C-J/A NOSEX	1.4	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.08	.01	.01
CRUSTACEA H-EXUVIAE	H-NYMPH	1.4	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0003	.0000	,08	.03	.03
DAPHNIA SP.	8-ADULT	2.9	2	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0002	.0001	.16	.03	.03
DAPHNIA SP.	A-JUV+ADULT	2.9	10	.1	3-7	.9	.00	.00	NEG.-NEG.	.00	.0001	.0000	.78	.10	.10
DAPHNIA SP.	C-J/A NOSEX	1.4	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0003	.0000	.08	.03	.03
BOSMINA SP.	8-ADULT	1.4	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0401	.0000	.08	.01	.01

APPENDIX D

Table 2. Chum Salmon (Continued)

SPECIES S7SS010202-ONCORHYNCHUS KETA CHUM SALMON

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	NORM. BIOMASS
OSTRACODA	C-J/A NOSEX	4.3	4	.1	1-	.3	.00	.00	NEG. - NEG.	.00	.0001	.0000	.31	.03	.03
CALANOIDA	8-ADULT	2.9	2	.0	1-2	.2	.@@	.00	NEG. - NEG.	.00	.0002	.0001	.16	.03	.93
CALANOIDA	A-JUV+ADULT	1.4	4	.1	4-1	.s	.00	.00	NEG.- NEG.	.00	.0001	.0000	.31	.0s	.06
CALANOIDA	C-J/A NOSEX	2.9	4	.1	1-4	.4	.00	.00	NEG. - NEG.	.00	.0002	.0000	.31	.09	.09
CALANOIDA	F-COPEPODID	17.4	49	.7	1-3 12	2.1	.01	.06	NEG.- .00	.00	.0002	.0002	3.82	.99	1.08
EPISCHURA SP.	A-JUV+ADULT	2.9	26	.4	9- 17	2.3	.02	.00	.b31- .01	.00	.0006	.0080	2.02	1.81	1.83
EPISCHURA SP.	F-COPEPODID	8.7	28	.4	1-	1.5	.01	.00	NEG. - .00	.00	.000s	.0002	2.18	1.S8	1.60
HARPACTICOIDA	8-ADULT	5.8	37	.s	2-8 22	2.9	.00	.00	NEG. - NEG.	.00	.0000	.0000	2.88	.06	06
CYCLOPOIDA	8-ADULT	5.8	8	.1	1-	.s	.00	.00	NEG. - NEG.	.00	.0001	.0000	.62	.07	.07
CYCLOPOIDA	A-JUV+ADULT	11.6	205	3.0	4-3 64	11.8	.00	.00	NEG.- NEG.	.00	.0000	.0000	1s.97	.43	.43
CYCLOPOIDA	F-COPEPODID	14.s	19	.3	1-	.8	.00	.0@	NEG. - NEG.	.68	.0001	.0000	1.48	.13	.13
SADURIA ENTOMON	7-JUVENILE	8.7	16	.2	I-s	.9	.02	.00	.00- .00	.08	.0013	.0006	1.25	2.13	2.16
GAMMARIDEA	7-JUVENILE	2.9	16	.2	I-s 1s	1.8	.00	.00	NEG. - .00	.00	.0001	.0000	1.2s	.29	.29
GAMMARIOAE	7-JUVENILE	1.4	29	.4	29- 29	3.5	.01	.00	.O1- .01	.00	.0002	.0000	2.26	.7@	.71
INSECTA	6-LARVA	4.3	4	.1	1- 2	.3	.00	.0$	NEG.- .00	.00	.0006	.0003	.31	.32	.33
INSECTA	8-ADULT	2.9	2	.0	1- 1	.2	.00	.00	NEG.- .00	.00	.0011	.000s	.16	.24	.24
INSECTA	C-J/A NOSEX	2.9	2	.0	1-	.2	.00	.00	.00- .00	.00	.0018	.0005	.16	.40	.41
INSECTA H-EXUVIAE	C-J/A NOSEX	2.9	14	.2	2-1 12	1.s	.01	.00	NEG. - .00	.00	.0003	.0001	1.09	.6a	.61
COLLEMBOLA	C-J/A NOSEX	8.7	34	.s	1- 24	2.9	.01	.00	NEG. - .00	.00	.0003	.0001	2.6S	.88	.91
EPHEMEROPTERA	H-NYMPH	1.4	1	.0	1-	.1	.01	.00	.01- .01	.@@	.0057	.0000	.08	.66	.66
HEPTAGENIIDAE	H-NYMPH	1.4	1	.0	1-1	.1	.01	.0@	.01- .01	.00	.0083	.0000	.08	.96	.97
PLECOPTERA	H-NYMPH	13.0	13	.2	1-1 2	.s	.138	.00	.00- .02	.00	.00S6	.0029	1.01	9.24	9.34
PSYLLIDAE	8-ADULT	1.4	1	.0	1- 1	.1	.00	.00	.88- .00	.00	.0012	.0000	.08	.14	.14
COLEOPTERA	6-LARVA	1.4	1	.0	1-	.1	.00	.00	.00- .00	.00	.0025	.0000	.08	.29	.29
STAPHYLINIDAE	8-ADULT	S.8	7	.1	1-1	.s	.01	.08	.88- .00	.00	.0014	.000s	.55	1.09	1.11
TRICOPTERA	8-ADULT	1.4	1	.0	1-3 1	.1	.01	.00	.O1- .01	.80	.0062	.0000	.08	.60	.61

APPENDIX D

Table 2. Chum Salmon (Continued)

SPECIES 8755010202-ONCORHYNCHUS KETA CHUM SALMON

PREY ORGANISM / PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
DIPTERA	6-LARVA	1.4	1	.0	1-	.1	.00	,00	NEG.- NEG.	.00	.0009	.0000	.08	.10	.10
DIPTERA	8-ADULT	5.8	5	.1	1- 2	.3	.01	,00	NEG.- .01	.00	.0032	.0046	.39	1.54	1.S6
DIPTERA H-EXUVIAE	G-PUPA	1.4	1	.0	1- 1	.1	.00	,00	NEG.- NEG.	.00	.0001	.0000	.08	.01	.01
CERATOPOGONIDAE	6-LARVA	2.9	2	.0	1-	.2	.00	,00	NEG.- .00	.00	.0008	.0007	.16	.18	.19
CERATOPOGONIDAE	8-ADULT	8.7	31	.4	1- 12	1.8	.01	.00	NEG.- .01	.00	.000s	.0002	2.41	1.59	1.61
NEMATOCERA	8-ADULT	4.3	5	.1	1-	.4	.00	.00	NEG.- .00	.@@	.0005	.0004	.39	.29	.29
NEMATOCERA H-EXUVIAE	G-PUPA	1.4	3	.0	3- 3	.4	.00	.00	.00- .00	.00	.0004	.0000	.23	.14	.14
TIPULIDAE	8-ADULT	1.4	4	.1	4- 4	.5	.03	,00	.03- .03	.00	.0084	.0000	.31	3.86	3.69
SIMULIDAE	8-ADULT	2.9	2	.0	1-	.2	.00	.00	NEG.- NEG.	.00	.0007	.0001	.16	.16	.16
DIPTERA-CHIRONOMIDAE	6-LARVA	34.8	61	.9	1- 12	2.0	.02	,00	NEG.- .01	.00	.0004	.0005	4.75	2.79	2.82
DIPTERA-CHIRONOMIDAE	8-ADULT	56.5	552	8.0	1- 79	18.5	.50	,01	NEG.- .10	.02	.0007	.0005	42.99	58.11	68.79
DIPTERA-CHIRONOMIDAE H-EXUVIAE	A-JUV+ADULT	1.4	8	.1	8- 8	1.0	.00	.00	.00- .00	.00	.0003	.0000	.62	.23	.23
DIPTERA-CHIRONOMIDAE	G-PUPA	11.6	37	.5	1- 24	3.0	.02	.00	NEG.- .01	.00	.0008	.0002	2.88	2,44	2.47
DIPTERA-CHIRONOMIDAE H-EXUVIAE	G-PUPA	7.2	11	.2	1- 3	.6	.00	.00	NEG.- NEG.	.%0	.0003	.0001	.86	.31	.31
DIPTERA-BRACHYCERA	8-ADULT	4.3	3	.0	1- 1	.2	.00	.00	NEG.- .00	.00	.0012	.0004	.23	.43	.43
DRYOMYZIDAE	8-ADULT	2.9	2	.0	1- 1	.2	.00	,00	NEG.- .00	.00	.0019	.0018	.16	.43	.43
EPHYDRIDAE	8-ADULT	2.9	2	.0	1- 1	.2	.00	,00	.00- .00	.00	.0022	.0003	.16	.51	.61
HYMENOPTERAN	8-ADULT	1.4	2	.0	2- 2	.2	.00	.00	.00- .00	.0a	.0008	.0000	.16	.17	.17
TENTHREDINIDAE	8-ADULT	1.4	1	.0	1- 1	.1	.01	,00	.01- .01	.00	.0064	.0000	.08	.74	.75
PLATYGASTERIDAE	8-ADULT	1.4	1	.0	1-	.1	.00	,00	NEG.- NEG.	.00	.0002	.0000	.08	.02	.02
TELEOSTEI	6-LARVA	1.4	1	.0	1-	.1	.00	.00	.00- .00	.00	.0042	.0000	.08	.48	.49
PLANTS AND PLANT PARTS	0-UNSTAGED	1.4	4	.1	4- 4	.5	.00	.00	. m- .00	.00	.0003	.0000	.31	.13	.13

APPENDIX D
Table 2. Chum Salmon (Continued)

****
SPECIES 8755010202-ONCORHYNCHUS KETA CHUM SALMON

UNIDENTIFIED MATERIAL	.01	.00	.EILI- .	.00	1.15

TOTAL NUMBER OF PREY CATEGORIES 55

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 3.40
BIOMASS 2.81
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.30

APPENDIX D

Table 3. Coho Salmon Stomach Composition

"SPECIES 8755010203-ONCORHYNCHUS KISUTCH COHO SALMON

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC.	NO. SPECIMENS	COLLECTION TIME (PST)
85JN16	BH1	30701	3	0
85JN25	W I	30301	1	1830
85JN25	P I	30603	1	1222

LIFE HISTORY STAGE
5 JUVENILE

TOTAL SAMPLE SIZE 5

NUMBER OF EMPTY STOMACHS 1
PERCENTAGE OF EMPTY STOMACHS 20.00
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 4

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	5.0	3.-7.	2.3
DIGESTION FACTOR (1-5, COMPLETE-NONE)	6.0	6.-5.	.0
TOTAL CONTENTS WEIGHT (GRAMS)	.17	NEG. - .59	.28
TOTAL CONTENTS ABUNDANCE (NUMBERS)	5.8	1.0- 17.0	7.6
NO. PREY CATEGORIES (PER STOMACH)	1.8	I.- 4.	1.5
LENGTH (MM)	89.4	87.- 94.	2.70
WEIGHT (GRAMS)	6.64	6.15- 7.23	.41
PCT RATIO OF CONTENTS WT TO PREDATOR WT	2.74	.01- 9.20	4.37

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	S.O.	AVE. BIOMASS MEAN	AVE. BIOMASS S.O.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
EPISCHURA SP.	F-COPEPODID	25.0	1	.3	1-	.5	.00	.00	NEG. - NEG.	,00	.0001	.0000	4.35	.41	.01
SADURIA ENTOMON	7-JUVENILE	26.0	13	3.3	13-1 13	6.S	,09	.02	,09- .09	.05	.0072	.0000	56.62	13.39	13.40
PLECOPTERA	H-NYMPH	25,0	1	.3	1- 1	.5	.00	.00	.ee- .00	.08	.0029	.0000	4.36	.42	,42

APPENDIX D

Table 3. Coho Salmon (Continued)

SPECIES 8755010203-ONCORHYNCHUS KISUTCH COHO SALMON

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
ONCORHYNCHUS SP.	7-JUVENILE	25.0	2	.5	2-2	1.0	.59	.1s	.59-.59	.29	.293S	.0000	8.70	84.47	84.54
PLANTS AND PLANT PARTS	Ø-UNSTAGED	75.0	6	1.5	1-3	1.3	.Ø1	.00	NEG.-.01	.00	.0015	.0011	26.Ø9	1.63	1.63
UNIDENTIFIED MATERIAL							.00	.00	.00-.00	.00				.09	

TOTAL NUMBER OF PREY CATEGORIES 5

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 1,67

BIOMASS .72

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 1.38

APPENDIX D

Table 4. Pink Salmon Stomach Composition

SPECIES 8755010201-ONCORHYNCHUS GORBUSCHA PINK SALMON

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC.	NO. SPECIMENS	COLLECTION TIME (PST)
85JN20	P I	30603	2	1644
85JN20	BH2	30703	10	0
85JN21	P 1	30101	5	1319
85JN21	P 2	30101	3	1427
85JN22	BH1	30704	7	1604
85JN23	W 1	30506	2	1820
85JY07	BH1	30708	2	1040
85JY21	P 2	30602	2	1660

LIFE HISTORY STAGE
33 JUVENILE

TOTAL SAMPLE SIZE 33

NUMBER OF EMPTY STOMACHS 7
PERCENTAGE OF EMPTY STOMACHS 21.21
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 26

PREY CODES TRUNCATED BY 4 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.7	2.-6.	1.3
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.7	3.-6.	.6
TOTAL CONTENTS WEIGHT (GRAMS)	.00	NEG. -.01	.00
TOTAL CONTENTS ABUNDANCE (NUMBERS)	18.5	1.0-62.0	15.5
NO. PREY CATEGORIES (PER STOMACH)	2.9	1.-“6.	1.6
LENGTH (MM)	38.8	32.-67	8.63
WEIGHT (GRAMS)	.37	.13-“1.96	.42
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.79	.03-2.88	.72

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

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APPENDIX D

Table 4. Pink Salmon (Continue.d)

SPECIES S7550102I31-ONCORHYNCHUS GORBUSCHA PINK SALMON

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
CALANOIDA	2-NAUPLIUS	7.7	2	.1	1- 1	.3	.00	,00	NEG.- NEG.	.00	.0001	.0000	,42	.47	.47
CALANOIDA	A-JUV+ADULT	3.8	16	.6	16- 16	3.1	.00	,00	NEG.- NEG.	.00	.0000	.0000	3.33	.70	.70
CALANOIDA	F-COPEPODID	34.8	166	6.4	1- 55	13.1	.00	.00	NEG.- .00	.00	.0000	.0000	34.61	9.11	9.11
EPISCHURA SP.	F-COPEPODID	19.2	16	.6	1- 9	1.9	.00	.00	NEG.- NEG.	.00	.0001	.0000	3.33	2.10	2.10
HARPACTICOIDA	8-ADULT	11.5	34	1.3	1- 27	5.4	.00	.00	NEG.- NEG.	.00	.0000	.0000	7.07	1.40	1.40
CANTHOCAMPTIDAE	8-ADULT	7.7	2	.1	1- 1	.3	.00	.00	NEG.- NEG.	.00	.0001	.0000	.42	.47	.47
CYCLOPOIDA	A-JUV+ADULT	30.8	132	5.1	3- 27	9.6	.00	.00	NEG.- NEG,	.00	.0000	.0000	27.44	6.78	6.78
CYCLOPOIDA	F-COPEPODID	11.5	11	.4	1- 8	1.6	.00	.00	NEG.- NEG.	.00	.0001	.0000	2.29	.93	.93
COLLEMBOLA H-EXUVIAE	C-J/A NOSEX	3.8	1	.0	1- 1	.2	.00	.00	NEG.- NEG.	.00	.0001	.0000	.21	.23	.23
COLLEMBOLA	C-J/A NOSEX	3.8	1	.0	1- 1	.2	.00	.00	NEG.- NEG.	.00	.0001	.0000	.21	.23	.23
HOMOPTERA	8-ADULT	3.8	1	.0	1- 1	.2	.00	.00	NEG.- NEG.	.00	.0004	.0000	.21	.93	.93
DIPTERA-CHIRONOMIDAE	6-LARVA	30.8	25	1.0	1- 12	2.6	.00	.00	NEG.- .00	.00	,0001	.0001	5.20	8.41	8.41
DIPTERA-CHIRONOMIDAE	8-ADULT	50.0	26	1.1	1- 8	1.8	.01	.00	NEG.- .00	,00	.0005	.0004	"5.82	22.43	22.43
DIPTERA-CHIRONOMIDAE	G-PUPA	38.5	24	.9	1- 6	1.6	.01	.00	NEG.- .00	.00	.0007	.0004	4.99	33.18	33.18
DIPTERA-CHIRONOMIDAE H-EXUVIAE	G-PUPA	26.9	21	.8	1- 12	2.4	.01	.00	NEG.- .00	.@@	.0001	.4001	4.37	12.15	12.15
PLANTS AND PLANT PARTS	1-EGG	3.8	1	.0	1- 1	.2	.00	.00	NEG.- NEG.	.00	.0002	.0000	.21	.47	.47
UNIDENTIFIED MATERIAL							.00	I*******	- .00	.00				.00	

TOTAL NUMBER OF PREY CATEGORIES 16

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 2.78

B1OMASS 2.79

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.69

APPENDIX D

Table 5. Sheefish Stomach Composition

SPECIES 8755010501-STENODUS LEUCICHTHYS SHEEFISH-INCONNU

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
85JY07	BH2	30708	6	1105
85JY12	BH1	30708	6	161s
85JY17	P 1	30601	6	1400
85JY18	P 1	30201	5	1335
85JY21	P 2	30602	6	1650
85JY24	W 1	30404	8	1845
85JY24	W I	30510	10	2200
85AU01	BH 1	30708	5	1547
85AU11	P 2	30202	4	1945
85AU16	P 1	30201	4	1226
85AU19	W 1	30305	6	806
85AU28	W 1	30510	5	0
85SE12	W 1	30303	7	1025
85SE16	W 1	30512	7	1202
85SE16	W 1	30401	6	1008
85SE17	W 1	30405	5	1641

Table 5. Sheefish (Continued)

SPECIES 8755010501-STENODUS LEUCICHTHYS SHEEFISH-INCONNU

LIFE HISTORY STAGE

94 JUVENILE

TOTAL SAMPLE SIZE 94

NUMBER OF EMPTY STOMACHS 28
PERCENTAGE OF EMPTY STOMACHS 29.79
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 66

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.330

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.2	2.-6.	1.1
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.6	2.-6.	.7
TOTAL CONTENTS WEIGHT (GRAMS)	.03	NEG.-.33	.05
TOTAL CONTENTS ABUNDANCE (NUMBERS)	7.8	1.0-46.0	9.9
NO. PREY CATEGORIES (PER STOMACH)	2.0	1.-7.	1.2
LENGTH (MM)	83.6	41.-127.	25.58
WEIGHT (GRAMS)	6.51	.43-19.08	5.73
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.35	.01-1.76	.42

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS,

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
ACARINA	C-J/A NOSEX	1.5	2	.0	2-2	.2	.@@	.00	NEG.-NEG.	.00	.0000	.0000	.39	.01	.01
DAPHNIA 5P.	8-ADULT	4.5	3	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0002	.0001	.68	.04	.04
DAPHNIA 5P.	A-JUV+ADULT	6.1	16	.2	3-5	1.0	.00	.00	NEG.-NEG.	.00	.0001	.0001	3.09	.11	.11
BOSMINA 5P.	8-ADULT	3.0	2	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0001	.0000	.39	.01	.01
OSTRACODA	C-J/A NOSEX	1.5	1	.0	1-	.1	.00	.00	.00-.00	.00	.0018	.0060	.19	.11	.11
CALANOIDA	8-ADULT	3.0	4	.1	1-3	.4	.00	.06	NEG.-NEG.	.00	.0001	.0061	.77	.02	.02
CALANOIDA	C-J/A NOSEX	1.5	1	.0	1-1	.1	.00	.00	.00-.00	.00	.0010	.0000	.19	.66	.06

APPENDIX D

Table 5. Sheefish (Continued)

SPECIES 8755010501-STENODUS LEUCICHTHYS SHEEFISH-INCONNU

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
CALANOIDA	F-COPEPODID	15.2	17	.3	1-	.7	,00	.00	NEG. - NEG.	.00	.0002	.0002	3.29	.16	.16
EPISCHURA 5P.	8-ADULT	4.5	3	.0	1-4	.2	.00	.00	NEG. - NEG.	.00	.0006	.0001	.68	.10	.10
EPISCHURA 5P.	A-JUV+ADULT	1.5	4	.1	4-4	.5	.ØØ	.ØØ	.00-.00	.00	.0066	.ØØØØ	.77	.12	.12
CYCLOPOIDA	8-ADULT	1.s	1	.Ø	1-1	.1	.ØØ	.00	NEG. - NEG.	,00	.0001	.ØØØØ	.19	.01	.01
CYCLOPOIDA	A-JUV+ADULT	6.1	39	.6	5-17	2.6	.00	.ØØ	NEG. - NEG.	.00	.ØØØØ	.0000	7.64	.08	.08
CYCLOPOIDA	F-COPEPODID	7.6	17	.3	1-8	1.2	.ØØ	.ØØ	NEG. - NEG.	.0a	.0001	.ØØØØ	3.29	.03	.03
MYSIDAE	7-JUVENILE	13.6	24	.4	1-6	1.1	.06	.00	.00-.02	.00	.0028	.0016	4.64	3.79	3.80
MYSIDAE	L-EGG-C FEM	3.Ø	2	.0	1-1	.2	.03	.00	.Ø2-.02	.00	.0166	.0006	.39	1.80	1.81
NEOMYSIS SP.	7-JUVENILE	30.3	167	2.5	1-46	7.3	.88	.Ø1	NEG. - .33	.05	.0046	.0026	32.30	61.64	61.87
NEOMYSIS 5P.	A-JUV+ADULT	1.5	36	.5	35-3s	4.3	.21	.00	.21-.21	.Ø3	.0060	.0000	6.77	12.34	12.40
HAUSTORIIDAE	7-JUVENILE	21.2	89	1.3	1-42	5.4	,22	.00	NEG. - .05	.01	.0036	.0029	17.21	12.56	12.60
HAUSTORIIDAE	8-ADULT	1.5	1	.0	1-1	.1	.01	.ØØ	.01-.01	.00	.ØØ71	.0000	.19	.41	.42
CRANGONIDAE	7-JUVENILE	4.5	3	.Ø	1-	.2	.Ø2	.00	.ØØ-.Ø1	.ØØ	.ØØ61	.0046	.58	1.07	1.08
INSECTA	8-ADULT	1.5	1	.Ø	1-1	.1	.00	.00	NEG. - NEG.	.00	.0006	.ØØØØ	.19	.03	.03
EPHEMEROPTERA	H-NYMPH	1.5	1	.0	1-1	.1	.00	.00	NEG. - NEG.	.ØØ	.0003	.ØØØØ	.19	.02	.02
HEPTAGENIIDAE	H-NYMPH	3.0	2	.Ø	1-1	.2'	,Ø2	.00	.Ø1-.Ø1	.ØØ	.0118	.0016	.39	1.37	1.38
PLECOPTERA	H-NYMPH	3.Ø	3	.Ø	1-2	.3	.01	.00	.00-.01	.00	.ØØ31	.0022	.68	.64	.84
HEMIPTERA	8-ADULT	1.5	1	.Ø	1-1	.1	.Ø1	.00	.01-.01	.00	.0064	.ØØØØ	.19	.37	.38
APHIDIDAE	8-ADULT	1.5	1	.0	1-	.1	.00	.06	NEG. - NEG.	.00	.ØØØ6	.ØØØØ	.19	.04	.04
CERATOPOGONIDAE	8-ADULT	1.5	1	.Ø	1-1	.1	.ØØ	.ØØ	NEG. - NEG.	.00	.0001	.ØØØØ	.19	.Ø1	.Ø1
NEMATOCERA	8-ADULT	1.5	1	.0	1-	.1	.ØØ	.00	NEG. - NEG.	.00	.0067	.ØØØØ	.19	.04	.04
TIPULIDAE	8-ADULT	1.5	1	.Ø	1-1	.1	.00	.00	.ØØ-.00	.00	.ØØ15	.0000	.19	.09	.09
BLEPHERICERIDAE	8-ADULT	1.5	1	.Ø	1-1	.1	.00	.00	NEG. - NEG.	.00	.0009	.0000	.19	.06	.06
DIPTERA-CHIRONOMIDAE	6-LARVA	15.2	14	.2	1-	.6	.00	.00	NEG. - .00	.00	.0004	.0003	2.71	.29	.29
DIPTERA-CHIRONOMIDAE	8-ADULT	16.7	51	.8	1-28	3.6	.04	.66	NEG.-.02	.06	.6069	.6613	9.86	2.12	2.13
DIPTERA-CHIRONOMIDAE	G-PUPA	1.5	1	.0	1-1	.1	.ØØ	.06	.00-.06	.ØØ	.6613	.0060	.19	.08	.08

APPENDIX D
Table 5, Sheefish (Continued)

SPECIES 8755010501-STENODUS LEUCICHTHYS SHEEFISH-INCONNU

PREY ORGANISM PARTS	LIFE HISTORY STAGE CODE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
EPHYDRIDAE	8-ADULT	3.0	2	.0	1-	.2	.00	.00	.00-.00	.00	.0014	.0002	.39	.16	.16
TENTHREDINIDAE	8-ADULT	1.5	1	.0	1-1	.1	.00	.00	.00-.00	.00	.0028	.0000	.19	.16	.16
TELEOSTEI	6-LARVA	1.s	1	.0	1-1	.1	.01	.00	.01-.01	.00	.0115	.0000	.19	.67	.67
TELEOSTEI	C-J/A NOSEX	1,5	1	.13	1-1	.1	.11	.00	.11-.11	.01	.1079	.0000	,19	6.30	6.33
TELEOSTEI D-TAILS	C-I/A NOSEX	1,5	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0004	.0000	.19	.02	.02
PUNGITIS PUNGITIUS	7-JUVENILE	1.5	1	.0	1-1	.1	,05	.00	.05-.05	.01	.0456	.0000	.19	2.66	2.67
UNIDENTIFIED MATERIAL							.01	.00	. m-.00	.00				.44	

TOTAL NUMBER OF PREY CATEGORIES 39

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 3.41
BIOMASS 2.53
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.26

APPENDIX D

Table 6. Humpback Whitefish Stomach Composition

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SPECIES 8755Ø10199-COREGONUS CF PIDSCHIAN GROUP HUMPBACK WHITEFISH GP

FROM COLLECTIONS	FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
	85JYØ8	W 1	30501	5	Ø
	85JY12	BH1	30708	s	1615
	85JY21	P 2	3Ø6Ø2	8	165Ø
	85JY24	W 1	3Ø4Ø4	6	1845
	85JY24	W2	30510	5	1845
	85AUØ7	W 1	30406	6	1825
	85AU12	W I	3Ø6Ø2	5	1516
	85AU12	BH1	3Ø7Ø2	5	183Ø
	85AU14	P 1	3Ø6Ø2	5	1138
	85AU2Ø	W I	3Ø4Ø4	5	16Ø5
	85AU2Ø	W 1	30510	5	165Ø
	85AU27	W 1	3Ø4Ø4	5	1456
	85SE12	W 1	3Ø3Ø3	7	1Ø25
	85SE12	W 1	3Ø4Ø6	4	1815
	85SE12	W2	30S13	5	161Ø
	85SE13	P 2	3Ø6Ø2	1Ø	1356
	85SE16	W 1	30512	5	12Ø2
	85SE17	W2	3Ø511	5	161Ø

APPENDIX D

Table 6. Humpback Whitefish (Continued)

SPECIES 8755010199-COREGONUS CF PIDSCHIAN CROUP HUMPBACK MITEFISH GP

LIFE HISTORY STAGE 99 JUVENILE

TOTAL SAMPLE SIZE 99

NUMBER OF EMPTY STOMACHS 31
PERCENTAGE OF EMPTY STOMACHS 31.31
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 68

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.330

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.1	2.-6,	1.1
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.3	2.-6.	1.1
TOTAL CONTENTS WEIGHT (GRAMS)	.01	NEG. -.13	.02
TOTAL CONTENTS AWNDANCE (NUMBERS)	46.4	1.Ø-440.Ø	84.1
NO. PREY CATEGORIES (PER STOMACH)	2.6	1.-i2.	2.3
LENGTH (MM)	65.6	32.-97	14.66
WEIGHT (GRAMS)	3.19	.21-" 11.1Ø	2.18
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.27	.ØØ-3,51	.52

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

PREY ORGANISM	PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S D	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S D	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
ROTIFERA	C-J/A	NOSEX	7.4	170	2.S	1-117	14.6	.00	.@@	NEG. -NEG.	.00	.0000	.ØØØØ	6.51	.15	.15
NEMATODA	C-J/A	NOSEX	2.9	3	.Ø	1-	.3	.@@	.00	NEG. -NEG.	.00	.ØØØ1	.ØØØØ	.1Ø	.04	.Ø4
OLIGOCHAETA	C-J/A	NOSEX	1.5	1	.0	1-1	,1	.00	.0%	NEG. -NEG.	.00	.0001	.0000	.03	.02	.02
ARANEAE	C-J/A	NOSEX	1.5	1	.Ø	1-1	.1	.00	.00	.00-.00	.00	.0019	.0000	.03	.42	.42
ACARINA	C-J/A	NOSEX	1.5	1	.Ø	1-1	.1	.00	.00	NEG. -NEG.	.00	.0001	.0000	.03	.02	.02
CRUSTACEA		I-EGG	1.5	5	.1	5-	.6	.00	.ØØ	NEG.-NEG.	.00	.0000	.ØØØØ	.16	.02	.02
CLADOCERA-EUCLADOCERA		8-ADULT	2.9	4	.1	2-2	.3	.06	.ØØ	NEG.-NEG.	.00	mom	.0000	.13	.Ø4	.Ø4

APPENDIX D

Table 6. Humpback Whitefish (Continued)

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SPECIES 8755010199-COREGONUS CF PIDSCHIAN GROUP HUMPBACK WHITEFISH GP

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	NORM. BIOMASS
CLADOCERA-EUCLADOCERA	C-J/A NOSEX	1.5	4	.1	4-	.6	.00	.00	NEG.-NEG.	.00	.0000	.0000	.13	.02	.02
DAPHNIDAE	8-ADULT	1.5	2	.0	2-4	.2	.00	.00	NEG.-NEG.	.00	.0000	.0000	.06	.02	.02
DAPHNIA SP.	8-ADULT	1.5	3	.0	3-2	.4	.00	.00	NEG.-NEG.	.00	.0000	.0000	.10	.02	.02
BOSMINA SP.	8-ADULT	7.4	26	.4	1-21	2.6	.00	.00	NEG.-NEG.	.00	.0001	.0000	.84	.17	.18
BOSMINA SP.	A-JUV+ADULT	1.5	16	.2	16-16	1.9	.00	.00	NEG.-NEG.	.00	.0000	.0000	.62	.04	.04
CHYDORIDAE	8-ADULT	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.03	.02	.02
CHYDORIDAE	A-JUV+ADULT	1.5	21	.3	21-21	2.5	.00	.00	NEG.-NEG.	.00	.0000	.0000	.68	.02	.02
OSTRACODA	C-J/A NOSEX	16.2	33	.6	1-	1.4	.00	.00	NEG.-NEG.	.00	.0001	.0000	1.07	.39	.46
PENAEIDEA	2-NAUPLIUS	5.9	26	,4	1-14	2.1	.00	.00	NEG.-NEG.	.00	.0001	.0001	.84	.09	.09
CALANOIDA	2-NAUPLIUS	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.03	.02	.02
CALANOIDA	8-ADULT	1.5	1	.0	1-1	.1	.013	.00	NEG.-NEG.	.00	.0003	.0000	.03	.07	.07
CALANOIDA	A-JUV+ADULT	4,4	172	2.5	18-94	13.6	.01	.00	NEG.-.00	.00	.0000	.0000	6.58	1.16	1.17
CALANOIDA	F-COPEPODID	22.1	36	.5	1-20	2.4	.00	.00	NEG.-NEG.	.00	.0001	.0000	1.13	.36	.36
EURYTEMORA SP.	8-ADULT	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.03	.02	.02
EURYTEMORA SP.	A-JUV+ADULT	4.4	249	3.7	17-129	19.9	.01	.00	NEG.-.00	.00	.0000	.0000	8.07	1.83	1.86
EURYTEMORA SP.	F-COPEPODID	2.9	4	.1	1-	.4	.00	.00	NEG.-NEG.	.00	.0001	.0000	.13	.07	.07
HARPACTICOIDA	8-ADULT	13.2	26	.4	1-11	1.5	.00	.00	NEG.-NEG.	.00	.0001	.0000	.84	.28	.29
HARPACTICOIDA	A-JUV+ADULT	20.6	391	6.8	3-125	20.6	.00	.00	NEG.-.00	.00	.0000	.0000	12.67	1.07	1.08
HARPACTICOIDA	C-J/A NOSEX	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.03	.02	.02
HARPACTICOIDA	F-COPEPODID	6.9	24	.4	1-10	1.6	.00	.00	NEG.-NEG.	.08	.0000	.0000	.78	.09	.09
TACHIDIUS SP.	A-JUV+ADULT	7.4	1294	19.0	149-437	73.8	.01	.00	.00-.00	.00	.0000	.0000	41.94	2.12	2.16
CYCLDPOIDA	8-ADULT	1.5	1	.0	1--1	.1	.@@	.00	NEG.-NEG.	.00	.0001	.0000	.03	.02	.02
CYCLOPOIDA	A-JUV+ADULT	4.4	39	.6	6-26	3.3	.00	.00	NEG.-NEG.	.00	.0000	.0000	1.26	.17	.18
CYCLOPOIDA	F-COPEPODID	16.2	297	4.4	1-82	14.6	.00	.00	NEG.-.00	.00	.0000	.0000	9.63	.81	.82
MYSIDAE	7-JUVENILE	2.9	7	.1	1-6	.7	.02	.00	NEG.-.02	.00	.0022	.0626	.23	6.35	6.42
NEOMYSIS S?.	A-JUV+ADULT	1.6	10	.1	10-10	1.2	.04	.06	.04-.04	. al	.6843	.0000	.32	9.37	9.49

APPENDIX D

Table 6. Humpback Whitefish (Continued)

SPECIES 875501 O199-COREGOF4JS CF PIDSCHIAN GROUP HUMPBACK WHITEFISH GP

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM BIOMASS
GAMMARIDEA	C-J/A NOSEX	5.9	4	.1	1-	.2	.00	.00	NEG.-.00	.00	.0011	.0010	.13	.94	.95
HAUSTORIIDAE	7-JUVENILE	7.4	10	.1	1-1	.6	.02	.00	NEG.-.01	.00	.0016	.0005	.32	3.58	3,63
HAUSTORIIDAE	8-ADULT	4.4	3	.0	1-3	.2	.01	.00	.00-.01	.00	.0040	.0025	.10	2.60	2.63
HAUSTORIIDAE	A-JUV+ADULT	7.4	99	1.5	5-36	6.3	.27	.00	.01-.13	.02	.0028	.0007	3.21	59.07	59.84
COLLEMBOLA	C-J/A NOSEX	5.9	37	.5	1-20	2.9	.00	.00	NEG.-NEG.	.00	.0000	.0000	1.20	.11	.11
EPHEMEROPTERA	H-NYMPH	1.5	1	.0	1-	.1	.00	.00	.60-.00	.00	.0023	.0000	.03	.50	.61
APHIDIDAE	8-ADULT	1.5	3	.0	3-3	.4	.00	.00	NEG.-NEG.	.00	.0002	.0000	.10	.11	.11
COLEOPTERA	8-ADULT	1.5	1	.0	1-1	.1	.00	.00	.00-.0@	.00	.0010	.0000	.03	.22	.22
TRICOPTERA	8-ADULT	1.5	1	.0	1-	.1	.01	.00	.01-.01	.00	.0117	.0000	.03	2.56	2.59
OIPTERA	6-LARVA	1.5	2	.0	2-2	.2	.00	,00	NEG.-NEG.	,00	.0003	.0000	.06	.13	.13
DIPTERA H-EXUVIAE	G-PUPA	1.5	1	.0	1-1	.1	.00	.00	.00-.60	.60	.0027	.0000	.03	.59	.60
OIPTERA-CHIRONOMIDAE	6-LARVA	20.6	30	.4	1-	1.1	.01	.00	NEG.-.00	.00	.0003	.0004	.97	1.35	1.37
DIPTERA-CHIRONOMIDAE	8-ADULT	4.4	14	.2	1-12	1.5	.00	.00	NEG.-.00	.00	.0006	.0005	.45	.63	.64
DIPTERA-CHIRONOMIDAE H-EXUVIAE	G-PUPA	2.9	3	.0	1-	.3	.00	.00	NEG.-NEG.	.00	.0003	.0001	.10	,17	.18
DIPTERA-CHIRONOMIDAE	G-PUPA	2.9	3	.0	1-2	.3	.00	.00	NEG.-NEG.	.00	.0003	.0000	.10	.17	.18
DIPTERA-BRACHYCERA	6-LARVA	2.9	2	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0007	.0004	.06	.28	.29
UNIDENTIFIED	C-J/A NOSEX	1.5	1	.0	1-1	.1	.01	.00	.al-.01	.00	.0061	.0000	.03	1.33	1.36
UNIDENTIFIED MATERIAL							.01	.00	.m3-.00	.00				1.29	

TOTAL NUMBER OF PREY CATEGORIES 50

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 3.13
BIOMASS 2.59

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 3.09

88/02/13. 00.07.23.IULP, 1.285, TLAS001,GEMC000,H0, 81817 **END OF LISTI

APPENDIX D

Table 7. Bering Cisco Stomach Composition

SPECIES 8755010102-COREGONUS LAURETTAE BERING CISCO

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
85AU10	P 1	30103	5	1713
85AU13	P I	30101	5	1344
85SE10	P 2	30102	5	1455
85SE16	W 1	30401	5	1008

LIFE HISTORY STAGE

20 JUVENILE

TOTAL SAMPLE SIZE 20

NUMBER OF EMPTY STOMACHS 1
PERCENTAGE OF EMPTY STOMACHS 5.00
ADJUSTED SAMPLE SIZE(STOMACHS CONTAINING PREY) 19

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.9	2.-6.	1.5
DIGESTION FACTOR (1-5, COMPLETE-NONE)	6.2	4.-6.	.7
TOTAL CONTENTS WEIGHT (GRAMS)	.07	NEG.-.38	.12
TOTAL CONTENTS ABUNDANCE (NUMBERS)	122.7	1.0-545.0	162.4
NO. PREY CATEGORIES (PER STOMACH)	2.0	1.-4.	1.0
LENGTH (MM)	84.3	67.-103.	11.55
WEIGHT (GRAMS)	7.42	3.13-13.67	3.38
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.71	.00-3.74	1.09

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS,

APPENDIX D
Table 7. Bering Cisco (Continued)

SPECIES 8755010102-COREGONUS LAURETTAE BERING CISCO

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	NORM. BIOMASS
BIVALVIA	6-LARVA	5.3	1	.1	1-	.2	.00	.00	NEG. - NEG.	.00	.0601	.0000	.04	.01	.01
PODON SP.	7-JUVENILE	5.3	1	.1	1- 1	.2	.00	.00	NEG. - NEG.	.06	.0001	.0060	.04	.01	.01
PODON SP.	8-ADULT	10.5	2	.1	1- 1 1	.3	.00	.00	NEG. - NEG.	.00	.0061	.0060	.09	.02	.02
CALANOIDA	2-NAUPLIUS	5.3	4	.2	4- 4	.9	.00	.00	NEG. - NEG.	.00	.0000	.0000	.17	.01	.01
CALANOIDA	A-JUV+ADULT	68.4	2139	112.6	2-" 544	166.9	.06	.00	NEG. - .01	.00	.0000	.0000	91.76	6.23	5.31
CALANOIDA	F-COPEPODID	5.3	1	.1	1- 1	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.04	.01	.01
HARPACTICOIDA	8-ADULT	5.3	1	.1	1-	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.04	.01	.01
HARPACTICOIDA	A-JUV+ADULT	6.3	3	.2	3-' 3	.7	.00	.00	NEG. - NEG.	.00	.0000	.0000	.13	.01	.01
HARPACTICOIDA	F-COPEPODID	10.5	2	.1	1- 1	.3	.00	.00	NEG. - NEG.	.00	.0001	.0000	.09	.02	.02
BALANOMORPHA	E-CYPRIS	6.3	1	.1	1-	.2	.00	.00	NEG. - NEG.	.00	.0001	.6000	.04	'.01	.01
MYSIDAE	7-JUVENILE	5.3	1	.1	1- 1 1	.2	.66	.00	NEG. - NEG.	.06	.0062	.0006	.04	.02	.02
NEOMYSIS SP.	7-JUVENILE	26.3	137	7.2	4- 47	16.0	.96	.05	.02- .32	.11	.0068	.0008	6.88	78.08	79.30
BOPYRIDAE	C-J/A NOSEX	6.3	1	.1	1-	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.04	.01	.01
HAUSTORIIDAE	8-ADULT	10.6	9	.6	1- 1	1.8	.05	.60	.01- .04	.01	.0064	.6000	.39	3.91	3.98
HAUSTORIIDAE	A-JUV+ADULT	5.3	10	.s	10- 8 10	2.3	.07	.00	.07- .07	.02	.4073	.0000	.43	6.88	6.98
CRANGONIDAE	6-LARVA	6.3	16	.8	15- 15	3.4	.01	.00	.O1- .01	.00	.0007	.0000	.64	.81	.82
DIPTERA-CHIRONOMIDAE	8-AD(.JI_T	10.5	2	.1	1-	.3	.00	. 0 6	NEG. - .00	.00	.0608	.0068	.09	.12	.12
TELEOSTEI	6-LARVA	5.3	1	.1	1 - 1 1	.2	.05	.00	.@6- .06	.01	.0531	.0000	.04	4.30	4.37
UNIDENTIFIED MATERIAL							.02	.00	. ::-	.60				1.66	

TOTAL NUMBER OF PREY CATEGORIES 18

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS .66
BIOMASS 1.20

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS .54

APPENDIX D

Table 8. Least Cisco Stomach Composition

SPECIES 8755010105-COREGONUS SARDINELLA LEAST CISCO

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC.	NO. SPECIMENS	COLLECTION TIME (PST)
85JY12	BH1	30708	5	1616
85JY18	P 1	30201	5	1336
85JY24	W 1	30404	3	184S
85JY24	W 2	30510	5	1845
85JY26	P 1	30102	6	1450
85AU14	P 1	30602	6	1138
85AU27	W3	30404	5	1456
85AU27	W3	30510	5	1330
85AU30	BH1	30708	5	1300
85SE12	W 1	30303	10	1026
85SE12	W 1	30406	5	1850
85SE12	W 1	30513	10	1610
85SE13	P 1	30602	7	1304
85SE16	W 1	30612	6	1202

Table 8. Least Cisco (Continued)

SPECIES 8755010105-COREGONUS SARDINELLA LEAST CISCO

LIFE HISTORY STAGE
80 JUVENILE

TOTAL SAMPLE SIZE 80

NUMBER OF EMPTY STOMACHS 15
PERCENTAGE OF EMPTY STOMACHS 18.75
ADJUSTED SAMPLE SIZE(STOMACHS CONTAINING PREY) 6S

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.0.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.5	2.-6.	1.2
DIGESTION FACTOR (1-5, COMPLETE-NONE)	3.9	2.-6.	.9
TOTAL CONTENTS WEIGHT (GRAMS)	.01	NEG.-.05	.01
TOTAL CONTENTS ABUNDANCE (NUMBERS)	204.5	1.0-3552.0	599.5
NO. PREY CATEGORIES (PER STOMACH)	2.9	1.-8.	1.8
LENGTH (MM)	71.2	36.-147.	22.05
WEIGHT (GRAMS)	4.80	.30-39.58	6.29
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.47	.00-4.15	.71

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.0.1 *	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D. *	* AVE. BIOMASS* MEAN	AVE. BIOMASS S.D. *	PERCENTAGES ABUN-DANCE	PERCENTAGES BIOMASS	NORM. BIOMASS
ARANEAE	C-J/A NOSEX	3.1	2	.0	1-	.2	.04	,00	NEG.-.00	.00	.0011	,0006	.02	.37	.44
CLADOCERA-EUCLADOCERA	C-J/A NOSEX	1.5	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.01	.02	.02
DAPHNIA SP.	8-ADULT	3.1	2	.0	1-	.2	.@@	.00	NEG.-NEG.	.00	.0002	.0001	.02	.05	.06
BOSMINA SP.	8-ADULT	6.2	9	.1	1-1	.6	.00	.00	NEG.-NEG.	.00	.0001	.0000	.07	.08	.10
BOSMINA SP.	A-JUV+ADULT	1.5	4	.1	4-3	.5	.00	.00	NEG.-NEG.	.00	.0001	.0000	.03	.05	.06
CHYDORIDAE	8-ADULT	1.5	1	.0	1-4	.1	.00	.00	NEG.-NEG.	.08	.0001	.0000	.01	.$2	.02
CHYDORIDAE	C-J/A NOSEX	7.7	21	.3	1-19	1.6	.00	.00	NEG.-NEG.	.08	.0001	.0000	.16	.00	.16

APPENDIX D

Table 8. Least Cisco (Continued)

'SPECIES 8755010105-COREGONUS SARDINELLA LEAST CISCO

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
OSTRACODA	C-J/A NOSEX	3.1	12	.2	5-	1.1	.00	.00	NEG.-NEG.	.00	.0000	.0000	.09	.08	.10
PENAEIDEA	2-NAUPLIUS	6.2	75	1.2	1-36	5.6	.00	.00	NEG.-NEG.	.00	.0000	.0000	.66	.07	.08
CALANOIDA	2-NAUPLIUS	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.01	.02	.02
CALANOIDA	8-ADULT	3.1	2	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0002	.0001	.02	.05	.06
CALANOIDA	A-JUV+ADULT	10.8	1336	20.6	3-408	80.7	.03	.00	NEG.-.01	.00	.0000	.0000	10.05	4,59	6.46
CALANOIDA	F-COPEPODID	26.2	508	7.8	1-198	30.0	.01	,00	NEG.-.00	.00	.0001	.0000	3.82	1.36	1.60
EURYTEMORA SP.	A-JUV+ADULT	15.4	1864	28.6	14-505	97.8	.06	.00	NEG.-.01	.00	.0000	.0000	13.95	10.04	11.92
EPILABIDOCERA LONGIPEDATA	8-ADULT	1.5	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0007	.0000	.01	.12	.14
HARPACTICOIDA	8-ADULT	13.8	148	2.3	1-112	14.0	.00	.00	NEG.-NEG.	.00	.0000	.0000	1.11	.18	.22
HARPACTICOIDA	A-JUV+ADULT	10.8	272	4.2	.6-138	18.4	.00	.00	NEG.-NEG.	.00	.0000	.0000	2.05	.33	.40
HARPACTICOIDA	F-COPEPODID	1.5	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.01	.02	.02
TACHIDIUS SP.	8-ADULT	1.5	2	.0	2-	.2	,00	.00	NEG.-NEG.	.00	.0000	.0000	.02	.02	.02
TACHIDIUS SP.	A-JUV+ADULT	13.8	8102	124.6	2-3144	560.1	.08	.00	NEG.-.03	,01	.0000	.0000	60.94	13.12	16.68
CYCLOPOIDA	8-ADULT	3.1	2	.0	1-	.2	.00	.00	NEG.-NEG.	.00	.0001	.0000	.02	,03	.04
CYCLOPOIDA	A-JUV+ADULT	3.1	13	.2	4-9	1.2	.00	.00	NEG.-NEG.	.00	.0000	.0000	.10	,07	.08
CYCLOPOIDA	F-COPEPODID	21.5	613	9.4	1-212	37.5	.00	.00	NEG.-.00	.00	.0000	.0000	4.61	.70	.83
MYSIDAE	7-JUVENILE	3.1	3	.0	1-2	.3	.01	.00	NEG.-.01	.00	.0017	.0017	.02	1.03	1,23
NEOMYSIS SP.	7-JUVENILE	10.8	11	.2	1-	.5	.04	.00	NEG.-.01	.00	.0036	.0028	.08	6.44	7.66
GAMMARIDEA	7-JUVENILE	3.1	4	.1	1-3	.4	.01	.00	NEG.-.01	.00	.0016	.0013	.03	1.38	1.64
GAMMARIDEA	8-ADULT	1.5	1	.0	1-3	.1	.00	.00	.00-.00	.00	.0018	.0000	.01	.30	.36
GAMMARIDEA	C-J/A NOSEX	4.6	3	.0	1-1	.2	.01	.00	.00-.01	.00	.0024	.0022	.02	1.22	1.44
HAUSTORIIDAE	7-JUVENILE	6.2	6	.1	1-1	.4	.02	.00	.00-.01	.00	.0031	.0014	.05	2.86	3.52
HAUSTORIIDAE	8-ADULT	3.1	3	.0	1-3	.3	.02	.00	.00-.01	,00	.0056	.0022	.02	3.03	3.60
HAUSTORIIDAE	A-JUV+ADULT	3.1	18	.3	4-14	1.8	.06	.00	.00-.05	.01	.0022	.0014	.14	8.36	9.93
INSECTA	6-LARVA	1.6	1	.0	1-	.1	.88	.68	NEG.-NEG.	.60	.0063	.0000	.01	.06	.68
INSECTA	8-ADULT	3.1	26	.4	1-24	3.0	.02	.00	NEG.-.02	.00	.0007	.6004	.19	4.01	4.77

APPENDIX D

Table 8. Least Cisco (Continued)

SPECIES 87 55010105-COREGONUS SARDINELLA LEAST CISCO

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM BIOMASS
COLLEMBOLA	C-J/A NOSEX	1.6	1	.0	1-	.1	.00	,00	NEG.-NEG.	.00	.0003	.0000	.01	.06	.06
EPHEMEROPTERA	H-NYMPH	3.1	2	.0	1-1	.2	.00	.00	.00-.00	.00	,0024	.0018	.02	.80	.9s
PSOCOPTERA	8-ADULT	1.5	2	.0	2-2	.2	.00	.00	.00-.00	.00	.0023	.0000	.02	.77	.91
THYSANOPTERA	8-ADULT	1.5	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.01	.02	.02
HOMOPTERA	8-ADULT	6.2	18	.3	1-10	1.4	.02	.0a	NEG.-.01	.@@	.0010	.0007	.14	3.66	4.33
APHIDIDAE	8-ADULT	4.6	4	.1	1-2	.3	.00	.00	NEG.-.00	.00	.0006	.0003	.03	.43	.51
TRICOPTERA	8-ADULT	1.5	1	.0	1-1	.1	.00	.00	NEG:-NEG.	.00	.0007	.0000	.01	.12	.14
DIPTERA	6-LARVA	1.5	2	.0	2-	.2	.00	.00	NEG.-NEG.	.00	.0002	.0000	.02	.05	.06
DIPTERA	8-ADULT	1.5	6	.1	5-2	.6	.01	.00	.01-.01	.00	.0014	.0000	.04	1.13	1.34
CERATOPOGONIDAE	8-ADULT	12.3	26	.4	1-5	1.3	.02	.00	NEG.-.01	.00	.0010	.0012	.20	3.10	3.68
NEMATOCERA	8-ADULT	1.s	5	.1	5-5	.6	.00	.00	.00-.00	.00	.0005	.0000	.04	.46	.63
TIPULIDAE	8-ADULT	4.6	3	.0	1-1	.2	.01	.00	.00-.00	.00	.0023	.0010	.02	1.13	1.34
DIPTERA-CHIRONOMIDAE	6-LARVA	3.1	4	.1	1-	.4	.00	.00	NEG.-NEG.	.0a	.0001	.0001	.03	.07	.08
DIPTERA-CHIRONOMIDAE	8-ADULTr	21.5	136	2.1	1-32	5.8	.04	.00	NEG.-.01	.00	.0004	.0%02	1.02	6.68	7.93
CHAOBORIDAE	8-LARVA	1.5	2	.0'	2-	.2	.00	.00	NEG.-NEG.	.00	.0003	.0000	.02	.08	.10
DIPTERA-BRACHYCERA	8-ADULTr	4.6	4	.1	1-2	.3	.01	.00	.00-.01	.00	.0029	.0010	.03	2.08	2.47
EPHYDRIDAE	8-ADULTr	1.5	1	.0	1-1	.1	.00	.00	.00-.00	.00	.0015	.0000	.01	.26	.30
MUSCIDAE	8-ADUL r	1.5	1	.0	1-	.1	.00	.00	.00-.00	.@@	.0031	.0000	.01	.62	.%1
HYMENOPTERA	8-ADULr	4.6	8	.1	2-3	.6	.01	.00	.00-.00	.00	.0013	.0006	.06	1.63	1.94
APOCRITA	8-ADULT	1.5	1	.0	1-1	.1	.@@	.00	.00-.00	.@@	.0038	.0000	.01	.63	.76
MYMARIDAE	8-ADULT	1.s	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.01	.02	.02
EULOPHIDAE	8-ADULT	1.s	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0003	.0000	.01	.06	.06
PLATYGASTERIDAE	8-ADULT	4.6	8	.1	1-	.5	.00	.00	NEG.-NEG.	.00	.0002	.0002	.06	.25	.30
UNIDENTIFIED	C-J/A NOSEX	1.5	2	.0	2-2	.2	.00	.08	NEG.-NEG.	.00	.0000	.0000	.02	.02	.02

APPENDIX D

Table 8. Least Cisco (Continued)

SPECIES 8755010105-COREGONUS SARDINELLA LEAST CISCO

UNIDENTIFIED MATERIAL	.10	.00	.OO- .02	.01	15.81

TOTAL NUMBER OF PREY CATEGORIES 67

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 2.04

BIOMASS 4.29

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.03

763

APPENDIX D

Table 9. Boreal Smelt Stomach Composition

SPECIES 8755030302-OSMERUS MORDAX BOREAL SMELT

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
85JN23	W I	30301	6	1834
85JY22	W I	30101	5	1130
85JY22	P I	30203	6	1351
85JY26	P 1	30102	5	1450
85AU04	W 1	30306	5	1200
85AU10	P I	30103	10	1713
85AU13	P 1	30101	5	1344
85SE04	P 1	30103	6	1633
85SE10	P 1	30192	10	1241

LIFE HISTORY STAGE

49 JUVENILE
9 ADULT

TOTAL SAMPLE SIZE 58

NUMBER OF EMPTY STOMACHS 10
PERCENTAGE OF EMPTY STOMACHS 17.24
ADJUSTED SAMPLE SIZE(STOMACHS CONTAINING PREY) 48

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT =S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	5.0	3.-7.	1.1
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4,6	3.-6.	.6
TOTAL CONTENTS WEIGHT (GRAMS)	.19	NEG. - 2.22	.37
TOTAL CONTENTS ABUNDANCE (NUMBERS)	98.4	1.0- 1836.0	299.6
NO. PREY CATEGORIES (PER STOMACH)	2.3	1.- 9.	1.6
LENGTH (MM)	96.1	57.- 148.	21.70
WEIGHT (GRAMS)	7.28	1.30- 25.43	4.97
PCT RATIO OF CONTENTS WT TO PREDATOR WT	1.76	.07- 8.74	1.76

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

APPENDIX D

Table 9. Boreal Smelt (Continued)

SPECIES 8755030302-OSMERUS MORDAX BOREAL SMELT

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	MEAN	RANGE	S.D.	BIOMASS TOTAL	MEAN	RANGE	S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	BIOMASS	NORM. BIOMASS
POLYCHAETA	6-LARVA	12.5	18	.4	1-10	1.5	,00	.00	NEG.-.00	.00	.0001	.0000	.38	.02	,02
PODON SP.	A-JUV+ADULT	6.3	90	1.9	10-88	10.0	.01	.00	NEG.-.00	.00	.0001	.0000	1.90	.06	.08
OSTRACODA	8-ADULT	2.1	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.02	.00	.00
CALANOIDA	8-ADULT	4.2	2	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0004	.0004	.04	.01	.01
CALANOIDA	A-JUV+ADULT	16.7	4052	84.4	28-1772	287.7	,35	.01	.00-.10	.02	.0001	.0000	86.78	3.88	3.89
CALANOIDA	F-COPEPODID	14.6	24	.5	1-8	1.6	.00	.00	NEG.-.00	.00	.0001	.0001	.51	.03	.03
EURYTEMORA SP.	F-COPEPODID	2.1	1	.0	1-	.1	,00	.00	NEG.-NEG.	.00	.0001	.0000	.02	.00	.06
EPILABIDOCERA LONGIPEDATA	8-ADULT	12.5	12	.3	1-7	1.0	,01	.00	NEG.-.@@	.00	.0006	.0003	,26	.08	.08
EPILABIDOCERA LONGIPEDATA	A-JUV+ADULT	2.1	10	.2	10-10	1.4	.00	.00	.aO-.00	.00	.0002	.0000	.21	.03	.03
HARPACTICOIDA	8-ADULT	2.1	1	.0	1-	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.02	.00	.00
HARPACTICOIDA	F-COPEPODID	2.1	4	.1	4-4	.6	.00	.00	NEG.-NEG.	.00	.0000	.0000	.08	.00	.00
CYCLOPOIDA	F-COPEPODID	2.1	1	.0	1-1	.1	.00	.00	NEG.-NEG.	.00	.0001	.0000	.02	.00	.00
BALANOMORPHA	E-CYPRIS	6.3	46	1.0	7-24	4.1	.00	.00	NEG.-.80	.00	.0001	.0000	.97	.06	.06
MYSIDAE	7-JUVENILE	31.3	324	8.8	1-83	20.3	.88	.02	NEG.-.23	.06	.0027	.0022	6.86	9.87	9.70
MYSIDAE	8-ADULT	16.7	12	.3	1-	.6	1.41	.03	.08-.34	.07	.1209	.0382	.26	16.63	15.58
MYSIDAE	A-JUV+ADULT	2.1	4	.1	4-	.6	.08	.00	.08-.08	.01	.0206	.0000	.08	.91	.91
MYSIDAE	L-EGG-C FEM	2.1	1	.0	1-	.1	.13	.00	.13-.13	.02	.1311	.0000	.02	1.46	1.46
NEOMYSIS SP.	7-JUVENILE	8.3	7	.1	1-3	.5	.06	.00	NEG.-.04	.01	.0079	.0071	.16	.66	.66
NEOMYSIS SP.	8-ADULT	6.3	5	.1	1-2	.4	.20	.00	.03-.12	.02	.0434	.0228	.11	2.26	2.27
SADURIA ENTOMON	7-JUVENILE	4.2	2	.0	1-1	.2	.00	.00	.0a-.00	.00	.0024	.0007	.04	.06	.06
GAMMARIDEA	7-JUVENILE	6.3	10	.2	1-	1.2	.02	.00	.aO-.02	.00	.0067	.0094	.21	.28	.26
GAMMARIDEA	8-ADULT	2.1	2	.0	2-2	.3	.03	.00	.03-.03	.00	.0143	.0000	.04	.32	.32
GAMMARIDEA	C-J/A NOSEX	2.1	1	.0	1-1	.1	.01	.00	.o1-.01	.00	.0101	.0000	.02	.11	.11
ATYLUS SP.	8-ADULT	4.2	4	.1	2-2	.4	.03	.00	.01-.02	.00	.0075	.0019	.08	.33	.33
HAUSTORIIDAE	7-JUVENILE	4,2	2	.0	1-1	.2	.02	.00	.80-.02	.80	.0108	.0888	.04	.22	.22
HAUSTORIIDAE	B-ADULT	2.1	2	.0	2-2	.3	.06	.00	.06-.06	.01	.0231	.0000	.04	.61	.61

APPENDIX D

Table 9. Boreal Smelt (Continued)

SPECIES 8755030302-OSMERUS MORDAX BOREAL SMELT

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM BIOMASS
AMPHIPODA-HYPERIIDEA	7-JUVENILE	2.1	2	.Ø	2-2	.3	.00	.@@	.00-.00	.00	.0011	.0000	.04	.02	.02
AMPHIPODA-HYPERIIDEA	8-ADULT	4.2	2	.0	1-1	.2	.01	.06	.00-.00	.00	.ØØ32	.0010	.04	.07	.Ø7
PLEOCYEMATA-CARIDEA	3-ZOEA	2.1	1	.0	1-1	.1	.00	.60	NEG.-NEG.	.00	.0003	.0000	.02	.00	.60
PLEOCYEMATA-CARIDEA	6-LARVA	6.3	48	1.Ø	4-28	4.6	.Ø1	.00	NEG.-.00	.00	.ØØØ2	.ØØØØ	1.02	.08	.08
DECAPODA-BRACHYURA	4-MEGALOP	4.2	12	.3	2-1Ø	1.5	.07	.00	.O1-.06	.01	.0059	.ØØ1Ø	.26	.72	.72
TELEOSTEI	6-LARVA	12.5	6	.1	1-1	.3	.20	.00	.Ø1-.05	.01	.0335	.0123	.13	2.22	2.23
TELEOSTEI	7-JUVENILE	6.3	11	.2	2-5	.9	4.64	.09	.24-2.22	.38	.4002	.1962	.23	5Ø.12	5Ø.27
TELEOSTEI	C-J/A NOSEX	4.2	2	.0	1-1	.2	.64	.01	.1Ø-.45	.07	.2720	.2491	.04	6.01	6.03
CLUPEA HARENGUS PALLASI	6-LARVA	4.2	2	.0	1-	.2	.20	.60	.Ø7-.12	.02	.Ø981	.0360	.04	2.17	2.17
CLUPEA HARENGUS PALLASI	7-JUVENILE	2.1	1	.0	1-1	.1	.17	.00	.17-.17	.02	.17ØØ	.ØØØØ	.02	1.88	1.88
UNIDENTIFIED MATERIAL							.03	.ØØ	.ØØ-.Ø1	.ØØ				.29	

TOTAL NUMBER OF PREY CATEGORIES 36

SHANNON-WEINER DIVERSITY INDEx (NORMALIZED) NUMBERS 1.Ø2

BIOMASS 2.59

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 1.60

86/02/14. ØØ.Ø6.Ø9.IULP, 0.22S, TLASØØ1,GEMCØØØ,HØ, 81817 ** END OF LISTI

APPENDIX D

Table 10. Pond Smelt Stomach Composition

SPECIES 8755030102-HYPOMESUS OLIDUS POND SMELT

FROM COLLECTIONS

FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
85JN23	W I	30505	5	1800
85AU04	W2	30306	5	0
85AU10	P 1	30103	5	1713
85AU10	P 1	30601	4	1128
85AU12	P 1	30602	5	1516
85AU13	P 1	30101	5	1344
85SE04	P 1	30103	8	1633

LIFE HISTORY STAGE

37 JUVENILE

TOTAL SAMPLE SIZE 37

NUMBER OF EMPTY STOMACHS 3
PERCENTAGE OF EMPTY STOMACHS 8.11
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 34

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.338

	MEAN	RANGE.	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	3.5	2.-6.	1.3
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4,3	2.-6.	1.1
TOTAL CONTENTS WEIGHT (GRAMS)	.01	NEG.-.03	.01
TOTAL CONTENTS ABUNDANCE (NUMBERS)	276.6	1.0-1764.0	477.6
NO. PREY CATEGORIES (PER STOMACH)	3.0	1.-9.	2.2
LENGTH (MM)	66.4	44.-103.	12.99
WEIGHT (GRAMS)	2.70	.42-10.75	2.15
PCT RATIO OF CONTENTS WT TO PREDATOR WT	.68	.00-3.57	.92

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

APPENDIX D

Table 10. Pond Smelt (Continued)

SPECIES 8755030102-HYPOMESUS OLIDUS POND SMELT

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
POLYCHAETA	6-LARVA	5.9	4	.1	1-	.5	.00	.00	NEG. - NEG.	.00	.0001	.0000	.04	.10	.10
NOTOSTRACA	C-J/A NOSEX	14.7	235	6.9	12-3 126	23.1	.01	.00	NEG. - .00	.00	.0000	.0000	2.48	1.68	1.78
CLADOCERA-EUCLADOCERA	C-J/A NOSEX	2.9	4	.1	4 -	.7	.@@	.00	NEG. - NEG.	,00	.0001	.0000	.04	.13	.14
BOSMINA SP.	7-JUVENILE	2.9	1	.0	1 -4	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.01	.03	.03
BOSMINA SP.	A-JUV+ADULT	2.9	3	.1	3 -1	.5	.00	.00	NEG. - NEG,	.00	.0000	.0000	.03	.03	.03
BOSMINA 5P.	C-J/A NOSEX	8.8	10	.3	1 -3	1.4	.00	.00	NEG. - NEG.	.00	.0001	.0000	.11	.13	.14
PODON SP.	8-ADULT	2.9	2	.1	2 -8 2	.3	.00	.00	NEG. - NEG.	.00	.0001	.0000	.02	.07	,07
CALANOIDA	2-NAUPLIUS	17.8	4424	130.1	3- 1424	36S.7	.01	.00	NE&,- .00	.00	.0000	.0000	46.72	3.78	4.60
CALANOIDA	8-ADULT	5.9	5	.1	2- 3	.6	.@@	.00	NEG. - NEG.	.00	.0000	.0000	,05	.07	.07
CALANOIDA	A-JUV+ADULT	32.4	2766	81.4	2- 659	167.8	.11	.00	NEG.- .03	.01	.0000	.0000	29.21	35.44	37.60
CALANOIDA	F-COPEPODID	44.1	424	12.5	1- 128	29.7	.01	.00	NEG. - .00	.00	.0000	.0000	4.48	2.37	2.51
EURYTEMORA SP.	A-JUV+ADULT	2.9	2	.1	2- 2	.3	.00	.00	NEG. - NEG.	.00	.0001	.0000	.02	.07	.07
EURYTEMORA SP.	F-COPEPODID	2.9	1	.0	1- 1	.2	.@@	.00	NEG. - NEG.	.00	.0001	.0000	,01	.03	.03
EPILABIDOCERA LONGIPEDATA	8-ADULT	5.9	3	.1	1-	.4	.00	.00	NEG. - .00	.00	.0007	.0001	.03	.69	.73
EPILABIDOCERA LONGIPEDATA	F-COPEPODID	2.9	1	.0	1 -2	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.01	.03	.03
HARPACTICOIDA	8-ADULT	8.8	4	.1	1 -1	.4	.00	.00	NEG. - NEG.	.00	.0001	.0000	.04	.10	.10
HARPACTICOIDA	A-JUV+ADULT	20.6	980	28.8	3 -2 368	61.1	.02	.00	NEG. - .01	.00	.0000	.0000	10.35	5.53	6.85
HARPACTICOIDA	F-COPEPODID	2.9	10	,3	10- 10	1.7	.00	.00	NEG. - NEG,	.00	.0000	.0000	.11	.07	.07
CYCLOPOIDA	A-JUV+ADULT	8.8	155	4.6	12- 76	17.1	.00	.00	NEG. - .00	.00	.0000	.0000	1.64	1.18	1.25
CYCLOPOIDA	F-COPEPODID	20.6	109	3.2	2- 41	8.3	.00	.00	NEG. - .00	.00	.0000	.0000	1.15	.99	1.04
MONSTRILLIDAE	8-ADULT	2.9	1	.0	1-	.2	.00	.00	NEG. - NEG.	.@@	.0004	.0000	.01	.13	.14
BALANOMORPHA	E-CYPRIS	14.7	6	.2	1 -1	.5	.00	.00	NEG. - NEG.	.00	.0001	.0000	.06	.26	.28
MYSIDAE	7-JUVENILE	8.6	16	.5	1 -2 14	2.4	.02	.00	NEG. - .02	.00	.0008	.0007	.17	7.44	7.87
NEOMYSIS SP.	A-JUV+ADULT	2.9	4	.1	4- A	.7	.02	.00	.02- .02	.00	.0042	.0000	.04	6.53	6.85
GAMMARIDEA	7-JUVENILE	2.9	1	.0	1--	.2	.00	ala	.00- .06	.00	.0010	.0000	.01	.33	.35
HAUSTORIIDAE	7-JUVENILE	14.7	226	6.6	7 -1 148	26.0	.0s	.06	NEG.- .03	.01	.0002	.0001	2.38	16.75	17.72

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APPENDIX D

Table 10. Pond Smelt (Continued)

SPECIES 8755030102-HYPOMESUS OLIDUS POND SMELT

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
CRANGONIDAE	B-LARVA+JUV	8.8	49	1.4	4-40	6.9	.03	.00	.00-.02	.00	.0006	.0001	.62	9.58	10.13
INSECTA	6-LARVA	2.9	1	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0002	.0000	.01	.07	,07
INSECTA H-EXUVIAE	H-NYMPH	2.9	1	.0	1-1	.2	.00	.00	NEG.-NEG.	.00	.0004	.0000	.01	.13	.14
COLLEMBOLA	C-J/A NOSEX	2.9	4	.1	4-4	.7	.00	.00	.00-.00	.00	.0003	.0000	.04	.39	.42
DIPTERA-CHIRONOMIDAE	6-LARVA	14.7	15	.4	1-8	1.5	.00	.00	NEG.-.00	.00	.0002	.0001	.16	1.12	1.18
DIPTERA-CHIRONOMIDAE	8-ADULT	2.9	4	.1	4-4	.7	.00	.00	NEG.-NEG.	.00	.0002	.0000	.04	.26	.28
UNIDENTIFIED MATERIAL							.02	.00	.ma-.00	.00				5.50	

TOTAL NUMBER OF PREY CATEGORIES 32

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 2.16

BIOMASS 3.01

BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.15

86/02/14. 00.05.08.IULP, 0.212, TLAS001,GEMC000, HO, 81817 ** END OF LISTI

APPENDIX D

Table 11. Burbot Stomach Composition

SPECIES 8791030801-LOTA LOTA BURBOT

FROM COLLECTIONS	FILE ID.	SAMPLE NO.	STATION LOC. NO.	SPECIMENS	COLLECTION TIME (PST)
	85JY24	W 1	30510	4	2200
	85AU01	BH1	30708	5	1547
	85AU03	BH1	30702	5	1545
	85AU08	W2	30513	5	1930
	85AU19	W I	30305	5	805
	85SE13	P 2	30602	5	1356

LIFE HISTORY STAGE

29 JUVENILE

TOTAL SAMPLE SIZE 29

NUMBER OF EMPTY STOMACHS 4
PERCENTAGE OF EMPTY STOMACHS 13.79
ADJUSTED SAMPLE SIZE (STOMACHS CONTAINING PREY) 25

PREY CODES TRUNCATED BY 0 DIGITS
LIFE HISTORY STAGES ARE UNPOOLED
DATA FORMAT = S240.33B

	MEAN	RANGE	S.D.
CONDITION FACTOR (1-7, EMPTY-DISTENDED)	4.8	2.-7.	1.5
DIGESTION FACTOR (1-5, COMPLETE-NONE)	4.3	3.-5.	.8
TOTAL CONTENTS WEIGHT (GRAMS)	.19	NEG.-.89	.24
TOTAL CONTENTS ABUNDANCE (NUMBERS)	27.0	1.0-176.0	36.9
NO. PREY CATEGORIES (PER STOMACH)	2.3	1.-6	1.4
LENGTH (MM)	73.7	39.-141	28.61
WEIGHT (GRAMS)	4.35	.39-20.51	5.51
PCT RATIO OF CONTENTS WT TO PREDATOR WT	3.70	.01-10.27	3.46

NOTE LENGTH AND WEIGHT STATISTICS ARE BASED ON THE TOTAL SAMPLE, INCLUDING EMPTY STOMACHS.

APPENDIX D

Table 11. Burbot (Continued)

SPECIES 8791030801-LOTA LOTA BURBOT

PREY ORGANISM PARTS CODE	LIFE HISTORY STAGE	FREQ OCCUR	NUMBER TOTAL	NUMBER MEAN	NUMBER RANGE	NUMBER S.D.	BIOMASS TOTAL	BIOMASS MEAN	BIOMASS RANGE	BIOMASS S.D.	AVE. BIOMASS MEAN	AVE. BIOMASS S.D.	PERCENTAGES ABUNDANCE	PERCENTAGES BIOMASS	PERCENTAGES NORM. BIOMASS
OSTRACODA	C-J/A NOSEX	28.0	67	2.3	1-30	6.6	.01	.00	NEG. - .00	.00	.0001	.0000	8.44	.18	.18
CALANOIDA	A-JUV+ADULT	4.0	3	.1	3-3	.6	.00	.00	NEG. - NEG.	.00	.0001	.0000	.44	.00	.00
CALANOIDA	F-COPEPODID	4.0	1	.0	1-1	.2	.00	.00	NEG. - NEG.	.00	.0001	.0000	.16	.00	.00
EURYTEMORA SP	8-ADULT	4.0	2	.1	2-	.4	.00	.00	NEG. - NEG.	.00	.0001	.0000	.30	.00	.00
EURYTEMORA SP.	A-JUV+ADULT	8.0	16	.6	7-2 9	2.2	.00	.00	NEG. - NEG.	.00	.0000	.0000	2.37	.02	.02
EURYTEMORA SP.	F-COPEPODID	4.0	4	.2	4-	.6	.00	.00	NEG. - NEG.	.00	.0000·	.0000	.69	.00	.00
HARPACTICOIDA	8-ADULT	8.0	4	.2	1-4	.6	.00	.00	NEG. - NEG.	.00	.0001	.0000	.69	.60	.00
CYCLOPOIDA	8-ADULT	4.0	2	.1	2-3	.4	.00	.00	NEG. - NEG.	.00	.0000	.0000	.30	.00	.00
CYCLOPOIDA	A-JUV+ADULT	8.0	121	4.8	2a-2 101	20.4	.00	.00	NEG. - .00	.00	.0000	.0000	17.93	.04	.04
CYCLOPOIDA	F-COPEPODID	4.0	1	.0	1-	.2	,00	.00	NEG. - NEG.	.00	.0001	.0000	.15	.00	.60
MYSIDAE	7-JUVENILE	12.0	42	1.7	2-1 29	6.1	.39	.02	.02-.26	.06	.0092	.0016	6.22	8.24	8.26
NEOMYSIS SP.	A-JUV+ADULT	32.0	301	12.0	11-69	21.1	1.97	.08	.06-.64	.17	.0067	.0026	44.69	41.53	41.66
SADURIA ENTOMON	7-JUVENILE	8.0	3	.1	1-	.4	.03	.00	.00-.02	.00	.0113	.0126	.44	.63	.63
GAMMARIDEA	7-JUVENILE	4.0	2	.1	2-2	.4	.01	.00	.O1-.01	.00	.0052	.0000	.30	.22	.22
HAUSTORIIDAE	7-JUVENILE	12.0	8	.3	1-2 5	1$1	.01	.00	.00-.01	.00	.0013	.0001	1.19	.20	.20
CRANGONIDAE	7-JUVENILE	4.0	1	.0	1-1	.2	.02	.00	.02-.02	.00	.0163	.0000	.16	.34	.34
COLLEMBOLA	C-J/A NOSEX	4.0	2	.1	2-	.4	.00	.00	NEG. - NEG.	.00	.0002	.0000	.30	.01	.01
EPHEMEROPTERA	H-NYMPH	4.0	2	.1	2-2	.4	.02	.00	.02-.02	.00	.0098	.0000	.30	.41	.41
CERATOPOGONIDAE	6-LARVA	4.0	3	.1	3-2	.6	.00	.00	NEG. - NEG.	.00	.0001	.0000	.44	.00	.00
DIPTERA-CHIRONOMIDAE	6-LARVA	32.0	88	3.6	1-3 55	11.2	.01	.00	NEG. - .01	.00	.0002	.0003	13.04	.30	.30
DIPTERA-CHIRONOMIDAE	8-ADULT	8.0	3	.1	1-2	.4	.00	.00	NEG. - NEG.	.00	.0003	.0001	.44	.02	.02
TELEOSTEI	7-JUVENILE	4.0	1	.0	1-1	.2	.34	.01	.34-.34	.07	.3374	.0000	.15	7.12	7.13
COREGONUS SP.	7-JUVENILE	12.0	4	.2	1-2	.5	1.13	.05	.27-.60	.13	.3184	.1682	.69	23.91	23.93
STENODUS LEUCICHTHYS	7-JUVENILE	4.0	1	.0	1-1	.2	.50	.02	.60-.60	.10	.5041	.0000	.16	10.64	10.65
PUNGITIS PUNGITIUS	7-JUVENILE	8.0	3	.1	1-2	.4	.29	.01	.09-.20	.04	.1228	.1668	.44	6.18	6.19

Table 11. Burbot (Continued)

SPECIES 87910308Ø1-LOTA LOTA BURBOT

UNIDENTIFIED MATERIAL	.00	.06	.06- .00	.66	.08

TOTAL NUMBER OF PREY CATEGORIES 25

SHANNON-WEINER DIVERSITY INDEX (NORMALIZED) NUMBERS 2.60
BIOMASS 2.37
BRILLOUIN-S DIVERSITY INDEX BASED ON NUMBERS 2.62

66/02/14. ØØ.Ø6.3Ø.IULP, 0.191, TLASØØ1,GEMCØØØ, HO, 81817 ** END OF LISTI

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